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Common Names of Stoneflies (Plecoptera) from the United States and Canada

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Introduction

Stoneflies are one of the important and often dominant orders of insects in North American stream ecosystems. They have remained generally poorly known to nonspecialists because of their cryptic habits, and often nocturnal activity. Larger species, or those that are colorful or important to flyfishers, have acquired regional or local names that vary from place to place. Names such as blacks, browns, greens, yellows, rollwings, needleflies, broadbacks, sallies, olives, stones, willowflies, or the generic names *Acroneuria, Isoperla, Pteronarcys* and others have become firmly established in fly fishing literature, and are used by flyfishers.

The following list of recommended common names of Plecoptera species from the United States and Canada was originally formulated by us, acting as a subcommittee of the North American Benthological Society Scientific and Common Names Committee. This committee was charged with producing comprehensive species checklists of North American aquatic invertebrates, including insects with assigned common names. The first of the intended series of special publications by the American Fisheries Society of scientific and common names of U.S. aquatic invertebrates was of mollusks (Turgeon *et al.*, 1988); the volumes on Insecta never followed. Our list is therefore provided because of the importance of stoneflies in aquatic ecosystems, and in an attempt to standardize common names for use by flyfishers and other individuals.

The more established vernacular names needleflies (Leuctridae), willowflies (Taeniopterygidae), stones (Perlidae), and salmonflies (Pteronarcyidae) were retained, and names that are descriptive of the morphology, habitat, ecology or represent less frequently used previous names of species were selected for the remaining families: snowflies (Capniidae), forestflies (Nemouridae), sallflies (Chloroperlidae), roachflies (Peltoperlidae), and springflies (Perlodinae; Perlodidae). The first name of each species was coined as an adjective modifier of the common family name, and is descriptive of the river system, geographic distribution, abundance, size, color, or other morphological character, emergence season, or person associated with the species. Selection of names largely followed 17 American Fisheries Society principles (Turgeon *et al.*, 1988) governing the selection of common names.

The distributional ranges of stoneflies and other aquatic insects vary from local endemics to widespread transcontinental distribution. For this reason, it was decided by the committee that one or more acronyms from the following coded list was necessary to convey a good picture of the occurrence of each species adequately.

Occurrence

NE	West Virginia, Kentucky northward
MW	Ohio, Indiana, Illinois, Iowa, Wisconsin, Minnesota, and Great Plains states
SE	Carolinas, Tennessee southward and west to coastal plains of Louisiana, eastern Texas
E	wider eastern, where there are some populations from both the Northeast and Southeast (including Appalachian Mountains)
O	Ozark endemics
NW	northern California northward (including Northern Rockies, Coastal, and Cascade Mountains)
SW	extreme southern California eastward to New Mexico, Arizona, and west Texas
W	wider western where there are some populations from both the Northwest and Southwest
M	Mexico

Scientific Name	Occurrence	Common Name
Order Plecoptera		
Family Capniidae		**Snowflies**
Allocapnia		
aurora Ricker 1952	E	Aurora Snowfly
brooksi Ross 1964	SE	Sevier Snowfly
cunninghami Ross & Ricker 1971	E	Karst Snowfly
curiosa Frison 1942	E	Peculiar Snowfly
forbesi Frison 1929	E, MW	Three-knobbed Snowfly
frisoni Ross & Ricker 1964	E, MW	Evansville Snowfly
frumi Kirchner 1982	SE	Monongahela Snowfly
fumosa Ross 1964	E	Smokies Snowfly
granulata (Claassen) 1924	E, MW	Common Snowfly
harperi Kirchner 1980	NE	Stonyfork Snowfly
illinoensis Frison 1935	E, MW	Illinois Snowfly
indianae Ricker 1952	NE, MW	Indiana Snowfly
jeanae Ross 1964	O	Osage Snowfly
loshada Ricker 1952	E	Recurved Snowfly
malverna Ross 1964	SE	Gulf Snowfly
maria Hanson 1942	NE	Two-knobbed Snowfly
minima (Newport) 1851	E, MW	Boreal Snowfly
mohri Ross & Ricker 1964	O	Ouachita Snowfly
mystica Frison 1929	E, MW	Moraine Snowfly
nivicola (Fitch) 1847	E, MW	Brook Snowfly
ohioensis Ross & Ricker 1964	E, MW	Ohio Snowfly
oribata Poulton & Stewart 1987	O	Bowed Snowfly
ozarkana Ross 1964	O	Ozark Snowfly
pechumani Ross & Ricker 1964	NE	St. Lawrence Snowfly
peltoides Ross & Ricker 1964	O	Shield Snowfly
perplexa Ross & Ricker 1971	SE	Perplexing Snowfly
polemistis Ross & Ricker 1971	SE	Black Warrior Snowfly
pygmaea (Burmeister) 1839	E, MW, W	Pygmy Snowfly
recta (Claassen) 1924	E, MW	Eastern Snowfly
rickeri Frison 1929	E, MW	Midwest Snowfly
sandersoni Ricker 1952	O	Notched Snowfly
simmonsi Kondratieff & Voshell 1980	NE	Spatulate Snowfly
smithi Ross & Ricker 1971	SE, MW	Three-lobed Snowfly
stannardi Ross 1964	E	Blueridge Snowfly
tennessa Ross & Ricker 1964	SE	Tennessee Snowfly
unzickeri Ross & Yamamoto 1966	SE	Cumberland Snowfly
virginiana Frison 1942	E	Virginia Snowfly
vivipara (Claassen) 1924	E, MW	Shortwing Snowfly
warreni Ross & Yamamoto 1966	O	Arkansas Snowfly
wrayi Ross 1964	E	Pristine Snowfly
zola Ricker 1952	E	Ash Snowfly
Bolshecapnia		
gregsoni (Ricker) 1965	NW	Alpine Snowfly
maculata Jewett 1954	W	Spotted Snowfly
milami (Nebeker & Gaufin) 1967	NW	Glacier Snowfly

Scientific Name	Occurrence	Common Name
***Bolshecapnia*, continued.**		
rogozera (Ricker) 1965	NW	Moosehorn Snowfly
sasquatchi (Ricker) 1965	NW	Sasquatch Snowfly
spenceri (Ricker) 1965	NW	Ice Snowfly
Capnia		
arapahoe Nelson & Kondratieff 1988	W	Arapahoe Snowfly
barberi Claassen 1924	W	Plumas Snowfly
californica Claassen 1924	W	California Snowfly
cheama Ricker 1965	NW	Cheama Snowfly
coloradensis Claassen 1937	W	Colorado Snowfly
confusa Claassen 1929	W	Widespread Snowfly
coyote Nelson & Baumann 1987	SW	Coyote Snowfly
decepta (Banks) 1897	W	Shortbeak Snowfly
elongata Claassen 1924	NW	Cascades Snowfly
erecta Jewett 1955	NW	Erect Snowfly
excavata Claassen 1924	NW	Saddleback Snowfly
fialai Nelson & Baumann	W	Humboldt Snowfly
giulianii Nelson & Baumann 1987	W	Whitney Snowfly
glabra Claassen 1924	W	Smooth Snowfly
gracilaria Claassen 1924	W	Slender Snowfly
hitchcocki Nelson & Baumann 1987	W	Arroyo Snowfly
hornigi Baumann & Sheldon 1984	W	Esmeralda Snowfly
inyo Nelson & Baumann 1987	W	Inyo Snowfly
jewetti Frison 1924	NW	Spring Snowfly
lacustra Jewett 1965	W	Lake Snowfly
licina Jewett 1954	NW	Bent Snowfly
lineata Hanson 1943	W	Straight Snowfly
mariposa Nelson & Baumann 1987	W	Mariposa Snowfly
melia Frison 1942	NW	Northwest Snowfly
mono Nelson & Baumann 1987	W	Mono Snowfly
nana Claassen 1924	W	Dwarf Snowfly
nearctica Banks 1918	NE, NW	Nearctic Snowfly
ophiona Nelson & Baumann 1987	W	Snakehead Snowfly
oregona Frison 1942	NW	Oregon Snowfly
palomar Nelson & Baumann 1987	SW	Palomar Snowfly
petila Jewett 1954	W	Thin Snowfly
pileata Jewett 1966	NW	Birdhead Snowfly
promota Frison 1937	NW	Pacific Snowfly
quadrituberosa Hitchcock 1958	W	Four-knobbed Snowfly
regilla Nelson & Baumann 1987	W	Royal Snowfly
saratoga Nelson & Baumann 1987	W	Saratoga Snowfly
scobina Jewett 1966	W	Rasp Snowfly
sequoia Nelson & Baumann 1987	W	Sequoia Snowfly
sextuberculata Jewett 1954	W	Six-knobbed Snowfly
shepardi Nelson & Baumann 1987	W	Yuba Snowfly
spinulosa Claassen 1937	W	San Gabriel Snowfly
teresa Claassen 1924	SW	Bernardino Snowfly
tumida Claassen 1924	NW	Swollen Snowfly
uintahi Gaufin 1964	W	Uintah Snowfly
umpqua Frison 1942	NW	Umpqua Snowfly
utahensis Gaufin & Jewett 1962	W	Utah Snowfly

Scientific Name	Occurrence	Common Name
***Capnia*, continued.**		
valhalla Nelson & Baumann 1987	SW	Viking Snowfly
ventura Nelson & Baumann 1987	SW	Ventura Snowfly
vernalis (Newport) 1851	E,W	Belly Snowfly
willametta Jewett 1955	NW	Willamette Snowfly
yosemite Nelson & Baumann 1987	W	Yosemite Snowfly
zukeli Hanson 1943	W	Idaho Snowfly
Capnura		
anas Nelson & Baumann 1987	NW	Duckhead Snowfly
elevata (Frison) 1942	NW	Thicklimb Snowfly
fibula (Claassen) 1924	SW	Southwest Snowfly
intermontana Nelson & Baumann 1987	W	Intermountain Snowfly
manitoba (Claassen) 1924	NE, MW	Manitoba Snowfly
venosa (Banks) 1900	W	Falcate Snowfly
wanica (Frison) 1944	W	Rare Snowfly
Eucapnopsis		
brevicauda Claassen 1924	W	Shorttailed Snowfly
Isocapnia		
abbreviata Frison 1942	NW	Shortlimb Snowfly
agassizi Ricker 1942	NW	Agassiz Snowfly
crinita (Needham & Claassen) 1925	W	Hooked Snowfly
fraseri Ricker 1943	NW	Fraser Snowfly
grandis (Banks) 1907	W	Giant Snowfly
hyalita Ricker 1959	W	Hyalite Snowfly
integra Hanson 1907	NW	Alberta Snowfly
missouri Ricker 1959	W	Headwaters Snowfly
mogila Ricker 1959	NW	Irregular Snowfly
spenceri Ricker 1943	W	Chilliwack Snowfly
vedderensis (Ricker) 1943	W	Vedder Snowfly
Mesocapnia		
arizonensis (Baumann & Gaufin) 1969	SW	Arizona Snowfly
autumna (Baumann & Gaufin) 1969	NW	Autumn Snowfly
bakeri (Banks) 1918	SW	Pomona Snowfly
bergi (Ricker) 1965	NW	Yukon Snowfly
bulbosa Nelson & Baumann 1990	W	Bulbous Snowfly
frisoni (Baumann & Gaufin) 1970	MW, W	Plains Snowfly
lapwae (Baumann & Gaufin) 1970	W	Lapwai Snowfly
oenone (Neave) 1929	NW	Wine Snowfly
ogotoruka (Jewett) 1964	NW	Ogotoruk Snowfly
porrecta (Jewett) 1954	W	Stretched Snowfly
projecta (Frison) 1937	W	Spined Snowfly
sugluka (Ricker)1965	NE	Sugluk Snowfly
variabilis (Klapalek) 1920	NW	Variable Snowfly
werneri (Baumann & Gaufin) 1970	SW	Sabino Snowfly
yoloensis (Baumann & Gaufin) 1970	W	Yolo Snowfly
Nemocapnia		
carolina Banks 1938	E, MW	Southern Snowfly

Scientific Name	Occurrence	Common Name
Paracapnia		
angulata Hanson 1942	E, MW, W	Angulate Snowfly
disala (Jewett) 1962	NW	Dirty Snowfly
ensicala (Jewett) 1962	NW	Sword Snowfly
opis (Newman) 1839	E, MW	Northeastern Snowfly
oswegaptera (Jewett) 1965	NW	Clatsop Snowfly
Utacapnia		
columbiana (Claassen) 1924	NW	Columbian Snowfly
distincta (Frison) 1937	W	Distinctive Snowfly
imbera (Nebeker & Gaufin) 1965	NW	Scappoose Snowfly
labradora (Ricker) 1954	NE	Labrador Snowfly
lemoniana (Nebeker & Gaufin) 1965	W	Wasatch Snowfly
logana (Nebeker & Gaufin) 1965	W	Logan Snowfly
nedia (Nebeker & Gaufin) 1966	W	Boise Snowfly
poda (Nebeker & Gaufin) 1965	W	Gunnison Snowfly
sierra (Nebeker & Gaufin) 1965	W	Sierra Snowfly
tahoensis (Nebeker & Gaufin) 1965	W	Tahoe Snowfly
trava (Nebeker & Gaufin) 1965	W	Yellowstone Snowfly
Famly Leuctridae — Leuctrinae		**Needleflies**
Calileuctra		
dobryi Shepard & Baumann 1995	SW	Elsmere Needlefly
ephemera Shepard & Baumann 1995	NW	Napa Needlefly
Despaxia		
augusta (Banks) 1907	W	Smooth Needlefly
Leuctra		
alabama James 1974	SE	Alabama Needlefly
alexanderi Hanson 1941	E	Anakeesta Needlefly
alta James 1974	SE	Alta Needlefly
baddecka Ricker 1965	NE	Maritime Needlefly
biloba Claassen 1923	E	Two-lobed Needlefly
carolinensis Claassen 1923	E	Carolina Needlefly
cottaquilla James 1974	SE	Tiny Needlefly
crossi James 1976	SE	Crossroads Needlefly
duplicata Claassen 1923	NE	Atlantic Needlefly
ferruginea (Walker) 1852	E, MW	Eastern Needlefly
grandis Banks 1906	E	Grand Needlefly
laura Hitchcock 1969	NE	Hampshire Needlefly
maria Hanson 1941	NE	Northeastern Needlefly
mitchellensis Hanson 1941	E	Mitchell Needlefly
moha Ricker 1952	SE	Blackwater Needlefly
monticola Hanson 1941	E	Mountain Needlefly
nephophila Hanson 1941	SE	Clouded Needlefly
paleo Poulton & Stewart 1991	O	Arkansas Needlefly
rickeri James 1976	E, MW	Spined Needlefly
sibleyi Claassen 1923	E, MW	Brook Needlefly
szczytkoi Stark & Stewart 1981	SE	Louisiana Needlefly

Scientific Name	Occurrence	Common Name
***Leuctra*, continued.**		
tenella Provancher 1876	E, MW	Broad-lobed Needlefly
tenuis (Pictet) 1841	E, MW, O	Narrow-lobed Needlefly
triloba Claassen 1923	E	Three-lobed Needlefly
truncata Claassen 1923	NE	Truncate Needlefly
variabilis Hanson 1941	NE	Variable Needlefly
Moselia		
infuscata (Claassen) 1923	W	Hairy Needlefly
Paraleuctra		
andersoni Harper & Wildman 1985	NW	Oregon Needlefly
	divisa (Hitchcock) 1958	W California Needlefly
	forcipata (Frison) 1937	W Bullshorn Needlefly
jewetti Nebeker & Gaufin 1966	W	Slender Needlefly
occidentalis (Banks) 1907	W	Western Needlefly
purcellana (Neave) 1934	W	Purcell Needlefly
rickeri Nebeker & Gaufin 1966	W	Spruce Needlefly
sara (Claassen) 1937	E	Appalachian Needlefly
vershina Gaufin & Ricker 1974	W	Summit Needlefly
Perlomyia		
collaris Banks 1906	NW	Black Needlefly
utahensis Needham & Claassen 1925	W	Utah Needlefly
Zealeuctra		
arnoldi Ricker & Ross 1969	SW	Plateau Needlefly
cherokee Stark & Stewart 1973	O	Cherokee Needlefly
claasseni (Frison) 1929	E, MW, O	Common Needlefly
fraxina Ricker & Ross 1969	E, MW	Ashcave Needlefly
hitei Ricker & Ross 1969	SW	Texas Needlefly
narfi Ricker & Ross 1969	MW, O	Northern Needlefly
warreni Ricker & Ross 1969	O	Early Needlefly
wachita Ricker & Ross 1969	O	Ouachita Needlefly
Famly Leuctridae — Megaleuctrinae		**Needleflies**
Megaleuctra		
complicata Claassen 1937	NW	Pacific Needlefly
flinti Baumann 1973	NE	Shenandoah Needlefly
kincaidi Frison 1942	NW	Cascades Needlefly
sierra Fields 1977	W	Sierra Needlefly
stigmata (Banks) 1900	NW	Giant Needlefly
williamsae Hanson 1941	SE	Smokies Needlefly

Scientific Name	Occurrence	Common Name
Family Nemouridae — Amphinemurinae		**Forestflies**
Amphinemura		
alabama Baumann 1996	SE	Alabama Forestfly
apache Baumann & Gaufin 1972	SW	Apache Forestfly
appalachia Baumann 1996	SE	Appalachian Forestfly
banksi Baumann & Gaufin 1972	W	Rockies Forestfly
delosa (Ricker) 1952	E, MW	Eastern Forestfly
linda (Ricker) 1952	E, MW	Lovely Forestfly
mexicana Baumann 1972	M	Mexican Forestfly
mockfordi (Ricker) 1952	SE	Tennessee Forestfly
mogollonica Baumann & Gaufin 1972	SW	Mogollon Forestfly
nigritta (Provancher) 1876	E, MW	Little Black Forestfly
puebla Baumann 1972	M	Puebla Forestfly
reinerti Baumann 1976	M	Oriental Forestfly
texana Baumann 1996	SE	Texas Forestfly
varshava (Ricker) 1952	NE, MW	Warsaw Forestfly
venusta (Banks) 1911	M, SW	Window Forestfly
wui (Claassen) 1923	E	Spiked Forestfly
Malenka		
bifurcata (Claassen) 1923	W	Forked Forestfly
biloba (Claassen) 1923	W, M	Two-lobed Forestfly
californica (Claassen) 1923	W	California Forestfly
coloradensis (Banks) 1897	W	Colorado Forestfly
cornuta (Claassen) 1923	NW	Horned Forestfly
depressa (Banks) 1898	W	Bluntlobe Forestfly
flexura (Claassen) 1923	W	Twisted Forestfly
marionae (Hitchcock) 1958	W	Sagehen Forestfly
perplexa (Frison) 1936	NW	Coast Forestfly
tina (Ricker) 1952	W	Tiny Forestfly
wenatchee (Ricker) 1965	NW	Wenatchee Forestfly
Family Nemouridae — Nemourinae		**Forestflies**
Lednia		
tumana (Ricker) 1952	W	Mist Forestfly
Nemoura		
arctica Esben-Petersen 1910	NE, NW	Arctic Forestfly
normani Ricker 1944	NW	Alaska Forestfly
rickeri Jewett 1971	NW	Nearctic Forestfly
spiniloba Jewett 1954	W	Spiny Forestfly
trispinosa Claassen 1923	NE, MW	Three-spined Forestfly
Ostrocerca		
albidipennis (Walker) 1852	E	Whitetailed Forestfly
complexa (Claassen) 1937	NE	Notched Forestfly
dimicki (Frison) 1936	NW	Hooked Forestfly
foersteri (Ricker) 1943	NW	Cascades Forestfly
prolongata (Claassen) 1923	NE	Bent Forestfly
truncata (Claassen) 1923	E, MW	Truncate Forestfly

Scientific Name	Occurrence	Common Name
Paranemoura		
claasseni Baumann 1996	NE	Boreal Forestfly
perfecta (Walker) 1852	E	Spotted Forestfly
Podmosta		
decepta (Frison) 1942	W	Least Forestfly
delicatula (Claassen) 1923	W	Delicate Forestfly
macdunnoughi (Ricker) 1947	NE	Maritime Forestfly
obscura (Frison) 1936	NW	Brown-veined Forestfly
weberi (Ricker) 1950	NW	Holarctic Forestfly
Prostoia		
besametsa (Ricker) 1943	W	Banded Forestfly
completa (Walker) 1852	E, MW, O	Central Forestfly
hallasi Kondratieff & Kirchner 1984	NE	Swamp Forestfly
similis (Hagen) 1861	E, MW, O	Longhorn Forestfly
Shipsa		
rotunda (Claassen) 1923	E, NW, O	Intrepid Forestfly
Soyedina		
carolinensis (Claassen) 1923	E	Carolina Forestfly
interrupta (Claassen) 1923	NW	Broken Forestfly
kondratieffi Baumann & Grubbs 1996	SE	Southeastern Forestfly
merritti Baumann & Grubbs 1996	NE	Powdermill Forestfly
nevadensis (Claassen) 1923	W	Nevada Forestfly
potteri (Baumann & Gaufin) 1971	NW	Idaho Forestfly
producta (Claassen) 1923	W	Knobbed Forestfly
vallicularia (Wu) 1923	E, MW	Valley Forestfly
washingtoni (Claassen) 1923	NE	Vernal Forestfly
Visoka		
cataractae (Neave) 1933	W	Cataract Forestfly
Zapada		
chila (Ricker) 1952	SE	Smokies Forestfly
cinctipes (Banks) 1897	W	Common Forestfly
columbiana (Claassen) 1923	W	Columbian Forestfly
cordillera (Baumann & Gaufin) 1971	W	Cordilleran Forestfly
frigida (Claassen) 1923	W	Frigid Forestfly
glacier (Baumann & Gaufin) 1971	NW	Glacier Forestfly
haysi (Ricker) 1943	W	Intermountain Forestfly
katahdin Baumann & Mingo 1987	NE	Katahdin Forestfly
oregonensis (Claassen) 1923	W	Oregon Forestfly
wahkeena (Jewett) 1954	NW	Wahkeena Forestfly

Scientific Name	Occurrence	Common Name
Family Taeniopterygidae – Brachypteryinae		**Willowflies**
Bolotoperla		
rossi (Frison) 1942	E	Smoky Willowfly
Doddsia		
occidentalis (Banks) 1900	W	Western Willowfly
Oemopteryx		
contorta (Needham & Claassen) 1925	E	Dark Willowfly
fosketti (Ricker)1964	W	Saskatoon Willowfly
glacialis (Newport) 1848	NE, MW	Canadian Willowfly
vanduzeea (Claassen) 1937	W	Alpine Willowfly
Strophopteryx		
appalachia Ricker & Ross 1975	E	Appalachian Willowfly
arkansae Ricker & Ross 1975	O	Arkansas Willowfly
cucullata Frison 1934	O	Kiamichi Willowfly
fasciata (Burmeister) 1839	E, MW, O	Mottled Willowfly
inaya Ricker & Ross 1975	SE	Carolina Willowfly
limata (Frison) 1942	E	Newfound Willowfly
Taenionema		
atlanticum Ricker & Ross 1975	E	Atlantic Willowfly
californicum (Needham & Claassen) 1925	W	California Willowfly
grinnelli (Banks) 1918	W	Angeles Willowfly
jacobii Stanger & Baumann 1993	SW	Southwest Willowfly
jewetti Stanger & Baumann 1993	NW	Columbia Willowfly
kincaidi (Hoppe) 1938	NW	Pale Willowfly
oregonense (Needham & Claassen) 1925	NW	Oregon Willowfly
pacificum (Banks) 1900	W	Pacific Willowfly
pallidum (Banks) 1902	W	Common Willowfly
raynorium (Claassen) 1937	W	Yosemite Willowfly
uinta Stanger & Baumann 1993	W	Uinta Willowfly
umatilla Stanger & Baumann 1993	NW	Umatilla Willowfly
Family Taeniopterygidae – Taeniopteryginae		**Willowflies**
Taeniopteryx		
burksi Ricker & Ross 1968	E, MW, O	Eastern Willowfly
lita Frison 1942	E, MW, O	Small Willowfly
lonicera Ricker & Ross 1968	E	Honeysuckle Willowfly
maura (Pictet) 1841	E, MW, O	Spinyleg Willowfly
metequi Ricker & Ross 1968	E, MW, O	Shortwing Willowfly
nelsoni Kondratieff & Kirchner 1982	NE	Cryptic Willowfly
nivalis (Fitch) 1847	E, MW, W	Boreal Willowfly
parvula Banks 1918	E, MW, O, W	Hooked Willowfly
robinae Kondratieff & Kirchner 1984	SE	Savannah Willowfly
starki Stewart & Szczytko 1974	SW	Texas Willowfly
ugola Ricker & Ross 1968	E	Cumberland Willowfly

Scientific Name	Occurrence	Common Name
Family Chloroperlidae — Chloroperlinae		**Sallflies**
Alakaskaperla		
ovibovis (Ricker) 1965	NW	Alaska Sallfly
Alloperla		
acadiana Harper 1984	NE	Brunswick Sallfly
aracoma Harper & Kirchner 1978	NE	Aracoma Sallfly
atlantica Baumann 1974	E, MW	Atlantic Sallfly
banksi Frison 1942	NE, MW	Tufted Sallfly
biserrata Nelson & Kondratieff 1980	NE	Dusky Sallfly
caddo Poulton & Stewart 1987	O	Caddo Sallfly
caudata Frison 1934	NE, O	Ozark Sallfly
chandleri Jewett 1954	W	Mariposa Sallfly
chloris Frison 1934	NE, MW	Triangular Sallfly
concolor Ricker 1935	NE	Duckhead Sallfly
delicata Frison 1935	W	Delicate Sallfly
fraterna Frison 1935	NW	Cascades Sallfly
furcula Surdick 1981	SE	Blackwater Sallfly
hamata Surdick 1981	SE,O	Barbed Sallfly
idei (Ricker) 1935	E	Vernal Sallfly
imbecilla (Say) 1823	NE, MW	Ohio Sallfly
leonarda Ricker 1952	E,O	Truncate Sallfly
medveda Ricker 1952	W	Beartooth Sallfly
nanina Banks 1911	E	Swannanoa Sallfly
natchez Surdick & Stark 1980	SE	Natchez Sallfly
neglecta Frison 1935	E	Tennessee Sallfly
ouachita Stark & Stewart 1983	O	Ouachita Sallfly
pilosa Needham & Claassen 1925	W	Hairy Sallfly
roberti Surdick 1981	MW	Illinois Sallfly
serrata Needham & Claassen 1925	W	Sawtooth Sallfly
severa (Hagen) 1861	W	Western Sallfly
usa Ricker 1952	E, MW	Appalachian Sallfly
voinae Ricker 1948	NE	Lawrence Sallfly
vostoki Ricker 1948	NE	Scotia Sallfly
Bisancora		
pastina (Jewett) 1962	M, W	Antelope Sallfly
rutriformis Surdick 1981	SW	Scooped Sallfly
Haploperla		
brevis (Banks) 1895	E, MW, O	Least Sallfly
chilnualna (Ricker) 1952	W	Yosemite Sallfly
chukcho (Surdick & Stark) 1980	SE	Loess Sallfly
orpha (Frison) 1937	NE, MW	Quadrate Sallfly
Neaviperla		
forcipata (Neave) 1929	NW	Forceps Sallfly
Plumiperla		
diversa (Frison) 1935	W	Margined Sallfly
spinosa (Surdick) 1981	W	Spiny Sallfly

Scientific Name	Occurrence	Common Name
Rasvena		
terna (Frison) 1942	E	Vermont Sallfly
Suwallia		
autumna (Hoppe) 1938	W	Autumn Sallfly
dubia (Frison) 1935	W	Pale Sallfly
lineosa (Banks) 1918	W	Lined Sallfly
marginata (Banks) 1897	NE, MW	York Sallfly
pallidula (Banks) 1904	W	Yellow Sallfly
sierra Baumann & Bottorff 1997	W	Sierra Sallfly
wardi Kondratieff & Kirchner 1991	W	Larimide Sallfly
Sweltsa		
adamantea Surdick 1995	NW	Washington Sallfly
albertensis (Needham & Claassen) 1925	NW	Alberta Sallfly
borealis (Banks) 1895	W	Boreal Sallfly
californica (Jewett) 1965	W	Chico Sallfly
coloradensis (Banks) 1898	W	Colorado Sallfly
continua (Banks) 1911	W	Gabriel Sallfly
cristata Surdick 1995	W	Utah Sallfly
exquisita (Frison) 1935	NW	Exquisite Sallfly
fidelis (Banks) 1920	W	Mountain Sallfly
gaufini Baumann 1973	W	Utah Sallfly
holstonensis Kondratieff & Kirchner 1998	NE	Holston Sallfly
hondo Baumann & Jacobi 1984	SW	Taos Sallfly
lamba (Needham & Claassen) 1925	W	Rheocrene Sallfly
lateralis (Banks) 1911	E	Curved Sallfly
mediana (Banks) 1911	E	Carolina Sallfly
naica (Provancher) 1876	NE, MW	Northeastern Sallfly
occidens (Frison) 1937	NW	Alpine Sallfly
onkos (Ricker) 1925	E	Ontario Sallfly
oregonensis (Frison) 1935	NW	Oregon Sallfly
pacifica (Banks) 1895	W	Pacific Sallfly
pisteri Baumann & Bottorff 1997	W	Coastal Sallfly
pocahontas Kirchner & Kondratieff 1988	SE	Pocahontas Sallfly
resima Surdick 1995	W	California Sallfly
revelstoka (Jewett) 1955	NW	Canadian Sallfly
tamalpa (Ricker) 1952	W	Tamalpais Sallfly
townesi (Ricker) 1952	W	Sierra Sallfly
umbonata Surdick 1995	NW	Shasta Sallfly
urticae (Ricker) 1952	E	Hooked Sallfly
voshelli Kondratieff & Kirchner 1991	E	Virginia Sallfly
Triznaka		
pintada (Ricker) 1952	W	Rough Sallfly
signata (Banks) 1895	W	Striped Sallfly
Family Chloroperlidae — Paraperlinae		**Sallflies**
Kathroperla		
perdita Banks 1920	W	Longhead Sallfly
takhoma Stark & Surdick 1987	NW	Slenderhead Sallfly

Scientific Name	Occurrence	Common Name
Paraperla		
frontalis (Banks) 1902	W	Hyporheic Sallfly
wilsoni Ricker 1965	NW	Chilliwack Sallfly
Utaperla		
gaspesiana Harper & Roy 1975	NE	Gaspe Sallfly
sopladora Ricker 1952	W	Black Sallfly
Family Peltoperlidae		**Roachflies**
Peltoperla		
arcuata Needham 1925	E	Appalachian Roachfly
tarteri Stark & Kondratieff 1987	NE	Virginia Roachfly
Sierraperla		
cora (Needham & Smith) 1916	W	Giant Roachfly
Soliperla		
campanula (Jewett) 1954	NW	Hood Roachfly
fenderi (Jewett) 1955	NW	Rainier Roachfly
quadrispinula (Jewett) 1954	W	Four-spined Roachfly
sierra Stark 1983	W	Sierra Roachfly
thyra (Needham & Smith) 1916	W	California Roachfly
tillamook Stark 1983	NW	Tillamook Roachfly
Tallaperla		
anna (Needham & Smith) 1916	E	Piedmont Roachfly
cornelia (Needham & Smith) 1916	SE	Southeastern Roachfly
elisa Stark 1983	SE	Highlands Roachfly
laurie (Ricker) 1952	SE	Yellow Roachfly
lobata Stark 1983	NE	Lobed Roachfly
maria (Needham & Smith) 1916	E	Common Roachfly
Viehoperla		
ada (Needham & Smith) 1916	SE	Pallid Roachfly
Yoraperla		
brevis (Banks) 1907	W	Least Roachfly
mariana (Ricker) 1943	NW	Brown Roachfly
nigrisoma (Banks) 1948	W	Black Roachfly
siletz Stark & Nelson 1994	W	Coastal Roachfly
Family Perlidae — Acroneuriinae		**Stones**
Acroneuria		
abnormis (Newman) 1838	E, MW, W	Common Stone
arenosa (Pictet) 1841	E	Eastern Stone
arida (Hagen) 1861	E	Elegant Stone
carolinensis (Banks) 1905	E	Carolina Stone
evoluta Klapalek 1909	E, O	Constricted Stone

Scientific Name	Occurrence	Common Name
***Acroneuria*, continued.**		
filicis Frison 1942	E, MW, O	Illinois Stone
flinti Stark & Gaufin 1976	NE	Manassas Stone
frisoni Stark & Baumann 1991	E, MW, O	Central Stone
hitchcocki Kondratieff & Kirchner 1988	SE	Kentucky Stone
internata (Walker) 1852	NE, MW, O	Lobed Stone
kosztarabi Kondratieff & Kirchner 1993	SE	Virginia Stone
lycorias (Newman) 1839	E, MW	Boreal Stone
ozarkensis Poulton & Stewart 1991	O	Ozark Stone
perplexa Frison 1937	E, MW, O	Enigmatic Stone
petersi Stark & Gaufin 1976	SE	Etowah Stone
Anacroneuria		
comanche Stark & Baumann 1987	SW	Comanche Stone
wipukupa Baumann & Olson 1984	SW	Redrock Stone
Attaneuria		
ruralis (Hagen) 1861	E, MW, O	Giant Stone
Beloneuria		
georgiana (Banks) 1914	SE	Georgia Stone
jamesae Stark & Szczytko 1976	SE	Cheaha Stone
stewarti Stark & Szczytko 1976	SE	Piedmont Stone
Calineuria		
californica (Banks) 1905	W	Western Stone
Doroneuria		
baumanni Stark & Gaufin 1974	W	Cascades Stone
theodora (Needham & Claassen) 1922	W	Montana Stone
Eccoptura		
xanthenes (Newman) 1838	E	Yellow Stone
Hansonoperla		
appalachia Nelson 1979	E	Appalachian Stone
cheaha Kondratieff & Kirchner 1996	SE	Alabama Stone
hokolesqua Kondratieff & Kirchner 1996	SE	Splendid Stone
Hesperoperla		
hoguei Baumann & Stark 1980	W	Banded Stone
pacifica (Banks) 1900	W	Golden Stone
Perlesta		
adena Stark 1989	MW	Adena Stone
baumanni Stark 1989	O	Darkwing Stone
bolukta Stark 1989	O	Truncate Stone
browni Stark 1989	O	Toothed Stone
cinctipes (Banks) 1905	MW	Plains Stone
decipiens Walsh (1862)	MW, SW, W	Widespread Stone
frisoni Banks 1948	SE	Blueridge Stone
fusca Poulton & Stewart	O	Tinted Stone
lagoi Stark 1989	SE	Gulf Stone

Scientific Name	Occurrence	Common Name
***Perlesta*, continued.**		
nelsoni Stark 1989	SE	Pale Stone
nitida Banks 1948	NE	Tiny Stone
placida (Hagen) 1861	E, MW, O, W	Freckled Stone
shubuta Stark 1989	SE, O	Cloudy Stone
teaysia Kirchner & Kondratieff 1997	SE	Teays Stone
xube Stark & Rhodes 1997	MW	Pawnee Stone
Perlinella		
drymo (Newman) 1839	E, MW, O	Striped Stone
ephyre (Newman) 1839	E, MW, O	Vernal Stone
zwicki Kondratieff, *et al.* 1988	E, MW	Blackwater Stone
Family Perlidae — Perlinae		**Stones**
Agnetina		
annulipes (Hagen) 1861	E	Southern Stone
capitata (Pictet) 1841	E, MW	Northern Stone
flavescens (Walsh) 1862	E, O	Midwestern Stone
Claassenia		
sabulosa (Banks) 1900	W	Shortwing Stone
Neoperla		
carlsoni Stark & Baumann 1978	E,O	Spiny Stone
catharae Stark & Baumann 1978	NE, O	Slippery Stone
choctaw Stark & Baumann 1978	NE, O	Choctaw Stone
clymene (Newman) 1839	E, MW, SW	Coastal Stone
coosa Smith & Stark 1998	SE	Coosa Stone
coxi Stark 1995	SE	Homochitto Stone
falayah Stark & Lentz 1988	O	Curved Stone
gaufini Stark & Baumann 1978	MW	Ohio Stone
harpi Ernst & Stewart 1986	O	Arkansas Stone
harrisi Stark & Lentz 1988	SE	Amber Stone
mainensis Banks 1948	NE	Maine Stone
occipitalis (Pictet) 1841	SE	Atlantic Stone
osage Stark & Lentz 1988	O	Osage Stone
robisoni Poulton & Stewart 1986	O	Slender Stone
stewarti Stark & Baumann 1978	E, MW	Multispine Stone
Paragnetina		
fumosa (Banks) 1902	SE	Smoky Stone
ichusa Stark & Szczytko 1981	SE	Widecollar Stone
immarginata (Say) 1823	E	Beautiful Stone
kansensis (Banks) 1905	E, MW	Pallid Stone
media (Walker) 1852	E, MW	Embossed Stone

Scientific Name	Occurrence	Common Name
Family Perlodidae — Isoperlinae		**Stripetails**
Calliperla		
luctuosa (Banks) 1906	W	Coast Stripetail
Cascadoperla		
trictura (Hoppe) 1938	NW	Cascades Stripetail
Clioperla		
clio (Newman) 1839	E, MW, O	Clio Stripetail
Cosumnoperla		
hypocrena Szczytko & Bottorff 1987	W	Cosumnes Stripetail
Isoperla		
acula Jewett 1962	W	Fresno Stripetail
adunca Jewett 1962	W	Arroyo Stripetail
baumanni Szczytko & Stewart 1984	W	California Stripetail
bellona Banks 1911	SE	Smokies Stripetail
bifurcata Szczytko & Stewart 1979	NW	Forked Stripetail
bilineata (Say) 1823	E, MW	Two-lined Stripetail
burksi Frison 1942	E, MW, O	Banded Stripetail
conspicua Frison 1935	MW	Rare Stripetail
cotta Ricker 1952	NE, MW	Ontario Stripetail
coushatta Szczytko & Stewart 1976	E, O	Coushatta Stripetail
davisi James 1974	SE	Alabama Stripetail
decepta Frison 1935	NE, MW	Yellow Stripetail
decolorata (Walker) 1852	NW	Bearlake Stripetail
denningi Jewett 1955	W	Angeles Stripetail
dicala Frison 1942	E, MW	Sable Stripetail
distincta Nelson 1976	SE	Twisted Stripetail
emarginata Harden & Mickel 1952	MW	Crescent Stripetail
extensa Claassen 1937	MW	Nebraska Stripetail
francesca Harper 1971	NE	Northeastern Stripetail
frisoni Illies 1966	NE, MW	Wisconsin Stripetail
fulva Claassen 1937	W	Western Stripetail
fusca Needham & Claassen 1925	NW	Waterton Stripetail
gibbsae Harper 1971	NE	Quebec Stripetail
gravitans (Needham & Claassen) 1925	NW	Olympia Stripetail
holochlora (Klapalek) 1923	E	Pale Stripetail
irregularis (Klapalek) 1923	SW	Texas Stripetail
jewetti Szczytko & Stewart 1976	W	Grande Stripetail
katmaiensis Szczytko & Stewart 1979	NW	Katmai Stripetail
lata Frison 1942	E, MW	Dark Stripetail
longiseta Banks 1906	MW, W	Plains Stripetail
major Nelson & Kondratieff 1983	NE	Big Stripetail
marlynia (Needham & Claassen) 1925	E, MW	Midwestern Stripetail
marmorata Needham & Claassen 1925	W	Red Stripetail
maxana Harden & Mickel 1952	MW	Minnesota Stripetail
miwok Bottorff & Szczytko 1990	W	Miwok Stripetail
mohri Frison 1935	NE, MW, O	Illinois Stripetail
montana (Banks) 1898	NE	Montane Stripetail
mormona Banks 1920	M, W	Mormon Stripetail

Scientific Name	Occurrence	Common Name
***Isoperla*, continued.**		
namata Frison 1942	NE, MW, O	Ozark Stripetail
nana (Walsh) 1862	E, MW	Least Stripetail
orata Frison 1942	E, MW	Colorless Stripetail
ouachita Stark & Stewart 1973	O	Ouachita Stripetail
petersoni Needham & Christenson 1927	W	Springs Stripetail
phalerata (Smith) 1917	W	Rockies Stripetail
pinta Frison 1937	M, W	Checkered Stripetail
quinquepunctata (Banks) 1902	M, W	Fivespot Stripetail
rainieri Jewett 1954	NW	Rainier Stripetail
richardsoni Frison 1935	NE, MW	Sterling Stripetail
roguensis Szczytko & Stewart 1984	NW	Rogue Stripetail
sagittata Szczytko & Stewart 1976	SE	Arrowhead Stripetail
signata (Banks) 1902	NE, MW	Transverse Stripetail
similis (Hagen) 1861	E	Black Stripetail
slossonae (Banks) 1911	NE, MW	Colorful Stripetail
sobria (Hagen) 1874	W	Colorado Stripetail
sordida Banks 1906	NW	Notched Stripetail
szczytkoi Poulton & Stewart 1987	O	Magazine Stripetail
tilasqua Szczytko & Stewart 1979	NW	Oregon Stripetail
transmarina (Newman) 1838	E, MW	Boreal Stripetail
Family Perlodidae — Perlodinae		**Springflies**
Arcynopteryx		
compacta (McLachlan) 1872	W, NE	Arctic Springfly
Baumannella		
alameda (Needham & Claassen) 1925	W	Alameda Springfly
Chernokrilus		
erratus (Claassen) 1925	W	California Springfly
misnomus (Claassen) 1925	W	Oregon Springfly
Cultus		
aestivalis (Needham & Claassen) 1925	W	Summer Springfly
decisus decisus (Walker) 1852	E, MW	Great Lakes Springfly
decisus isolatus (Banks) 1920	SE	Southern Springfly
pilatus (Frison) 1942	NW	Vedder Springfly
tostonus (Ricker) 1943	W	Toston Springfly
verticalis (Banks) 1920	E	Spiny Springfly
Diploperla		
duplicata (Banks) 1920	E	Two-lobed Springfly
kanawholensis Kirchner & Kondratieff 1984	NE	Kanawhole Springfly
morgani Kondratieff & Voshell 1979	NE	Virginia Springfly
robusta Stark & Gaufin 1974	NE, MW	Robust Springfly
Diura		
bicaudata (Linnaeus) 1758	NW	Lapland Springfly
knowltoni (Frison) 1937	W	Nearctic Springfly
nanseni (Kempny) 1900	NE	Arctic Springfly

Scientific Name	Occurrence	Common Name
Frisonia		
picticeps (Hanson) 1942	W	Painted Springfly
Helopicus		
bogaloosa Stark & Ray 1983	SE	Masked Springfly
nalatus (Frison) 1942	MW, O	Ozark Springfly
subvarians (Banks) 1920	E	Vernal Springfly
Hydroperla		
crosbyi (Needham & Claassen) 1925	MW, O	Early Springfly
fugitans (Needham & Claassen) 1925	MW, O	Austin Springfly
phormidia Ray & Stark 1981	SE	Brownwater Springfly
rickeri (Stark) 1984	SE	Tennessee Springfly
Isogenoides		
colubrinus (Hagen) 1874	W	Blackfoot Springfly
doratus (Frison) 1942	E, MW	Indiana Springfly
elongatus (Hagen) 1874	W	Elongate Springfly
frontalis (Newman) 1838	NE, MW	Hudsonian Springfly
hansoni (Ricker) 1952	E	Appalachian Springfly
krumholzi (Ricker) 1952	MW	Michigan Springfly
olivaceus (Walker) 1852	NE, MW	Olive Springfly
varians (Walsh) 1862	MW, SE	Rock Island Springfly
zionensis Hanson 1949	W	Zion Springfly
Kogotus		
modestus (Banks) 1908	W	Sickle Springfly
nonus (Needham & Claassen) 1925	W	Smooth Springfly
Malirekus		
hastatus (Banks) 1920	E	Brook Springfly
iroquois Stark & Szczytko 1988	NE	Iroquois Springfly
Megarcys		
irregularis (Banks) 1900	NW	Rainier Springfly
signata (Hagen) 1874	W	Larimide Springfly
subtruncata Hanson 1925	NW	Truncate Springfly
watertoni (Ricker) 1952	NW	Glacier Springfly
yosemite (Needham & Claassen) 1925	W	Yosemite Springfly
Oconoperla		
innubila (Needham & Claassen) 1925	SE	Hairy Springfly
Oroperla		
barbara Needham 1933	W	Gilltail Springfly
Osobenus		
yakimae (Hoppe) 1938	W	Yakima Springfly
Perlinodes		
aurea (Smith) 1917	W	Longgill Springfly

Scientific Name	Occurrence	Common Name
Pictetiella		
expansa (Banks) 1920	W	Autumn Springfly
Remenus		
bilobatus (Needham & Claassen) 1925	E	Lash Springfly
duffieldi Nelson & Kondratieff 1995	SE	Georgia Springfly
kirchneri Kondratieff & Nelson 1995		Blueridge Springfly
Rickera		
sorpta (Needham & Claassen) 1925	W	Palestripe Springfly
Salmoperla		
sylvanica Baumann & Lauck 1987	NW	Bighead Springfly
Setvena		
bradleyi (Smith) 1917	NW	Alberta Springfly
tibialis (Banks) 1914	NW	Olympic Springfly
wahkeena Stewart & Stanger 1985	NW	Wahkeena Springfly
Skwala		
americana (Klapalek 1912)	W	American Springfly
curvata (Hanson) 1942	W	Curved Springfly
Susulus		
venustus (Jewett) 1954	W	Beautiful Springfly
Yugus		
arinus (Frison) 1942	E	Highlands Springfly
bulbosus (Frison) 1942	E	Greenbrier Springfly
Family Pteronarcyidae		**Salmonflies**
Pteronarcella		
badia (Hagen) 1874	W	Least Salmonfly
regularis (Hagen) 1874	W	Dwarf Salmonfly
Pteronarcys		
biloba Newman 1838	E	Knobbed Salmonfly
californica Newport 1851	W	Giant Salmonfly
comstocki Smith 1917	NE	Spiny Salmonfly
dorsata (Say) 1823	MW, NE, NW	American Salmonfly
pictetii Hagen 1873	E, MW, O	Midwestern Salmonfly
princeps Banks 1907	W	Ebony Salmonfly
proteus Newman 1838	E	Appalachian Salmonfly
scotti Ricker 1952	E	Carolina Salmonfly

Literature Cited

Turgeon, Donna D., Arthur E. Bogan, Eugene V. Coan, William K. Emerson, William G. Lyons, William L. Pratt, Clyde F. E. Roper, Amelie Scheltema, Fred G. Thompson, and James D. Williams. 1988. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. American Fisheries Society Special Publication 16. American Fisheries Society. Bethesda, Maryland. 277 p.

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Freshwater Mussel Surveys of the Big Darby Creek System in Central Ohio

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Introduction

Big Darby Creek in central Ohio, for its size, has the greatest diversity of freshwater mussels in North America (Watters, 1994). Forty species have been reported from the system, including two federally endangered species, seven Ohio endangered species, four Ohio threatened species, and three Ohio special interest species. A survey in 1986 found 38 of these species (Watters, 1986), whereas a follow-up survey in 1990 found 35 (Watters, 1990). These surveys suggest that the fauna was declining, both in species richness and numbers of individuals. A third survey was conducted in 1995-1996 (Watters, 1996a). The purpose of these surveys was to establish baseline data against which future changes may be gauged.

Establishing baseline data for mussels in a watershed is difficult. Results are confounded by variations in water levels, collecting methods, and the constantly changing nature of the sites. Sites that once were soybean fields are now bedroom communities. Wooded riparian corridors are replaced by mowed, fertilized, insect-free lawns. Bridges are replaced or moved. Agricultural methods change on a regular basis. Thus the goal of baseline data may be unreachable, as the creek system rapidly changes.

Methods

One hundred sites were sampled over the three surveys (Figure 1). Sites were surveyed by wading, and glass-bottom buckets were used for locating mussels. All individuals, living, dead, and weathered, were collected and identified. All living animals were returned to the stream. Shells were kept as vouchers as needed and deposited at The Ohio State University Museum of Biological Diversity.

Results and Discussion

Thirty-five species were found in the 1995-1996 survey, the same number (but not species) as found in 1990, but less than in the 1988 survey (Table 1). Nine listed species were encountered. Figure 2 depicts the species diversity site-by-site from mouth to headwaters by river mile (RM). Fewer species were found at most sites in 1990 and 1996 than in 1986. This may be due, at least in part, to the exceptional survey conditions in 1986. A severe drought in 1986 resulted in the stranding of numerous mussels, rendering collection extremely easy. By contrast, 1996 had above-normal precipitation. Although survey work was conducted to maximize the likelihood of encountering as many species as possible, no mussels were stranded or otherwise unburied. This alone probably accounts for some of the departure in terms of diversity of 1996 from 1986. Most of the species not encountered in 1996 were rare in 1986. The 1986 drought continued for several years and undoubtedly resulted in the death of a large portion of the mussel fauna.

The greatest diversity of mussels in Big Darby Creek occurs in the lower half of the main stem, from the Battelle-Darby Metro Park region to Fox (Figure 2). However, this area has experienced a pronounced increase in water turbidity. Several very rare species, including the Northern Riffleshell, which previously existed in this stretch, were not found in this survey. A number of areas have unusually low diversity. Hellbranch Run, with its runoff and sewage outfall problems, enters Big Darby Creek at ~RM 26. Its impact can be seen for several miles downstream. Other problem areas include the confluence of Buck Run, devoid of mussels for much of its length, and Big Darby at ~RM 65, and abandoned quarries at RM 45. Site 33 at Ohio Route 104 is a mystery. In 1988, 19 species were found there, but in 1990 and 1996, only two and six species, respectively. This area has a high fish diversity and suitable habitat is present. The near extirpation of mussels from this site has not been explained.

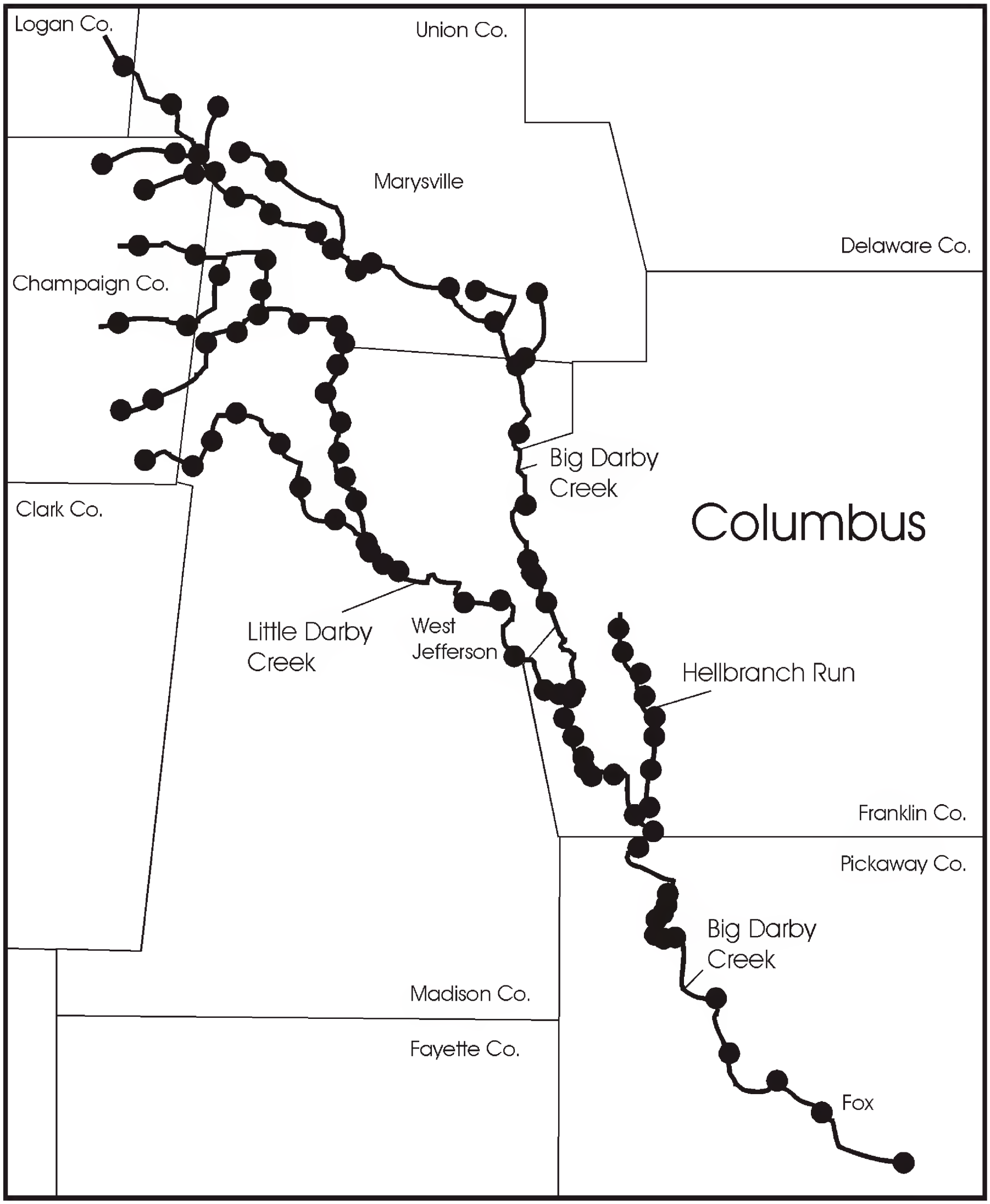

Figure 1. Map of collection locations (solid circles) on Big Darby Creek and Little Darby Creek.

Table 1. Comparison of 1986, 1990, and 1996 surveys.

Taxon	Common Name	Status	1986	1990	1996
Ligumia recta	Black Sandshell	OT	X	X	
Pleurobema clava	Clubshell	FE, OE	X	X	X
Lasmigona compressa	Creek Heelsplitter		X	X	X
Anodontoides ferussacianus	Cylindrical Papershell		X	X	X
Truncilla truncata	Deertoe	OSI	X		
Elliptio crassidens	Elephant Ear	OE	X		
Alasmidonta marginata	Elktoe		X	X	X
Lampsilis radiata luteola	Fat Mucket		X	X	X
Truncilla donaciformis	Fawnsfoot	OT	X	X	X
Lasmigona costata	Fluted-shell		X	X	X
Leptodea fragilis	Fragile Papershell		X	X	X
Pyganodon grandis	Giant Floater		X	X	X
Ptychobranchus fasciolaris	Kidneyshell		X	X	X
Toxolasma parvus	Lilliput		X	X	X
Quadrula quadrula	Mapleleaf		X	X	X
Epioblasma rangiana	Northern Riffleshell	FE, OE	X	X	X
Utterbackia imbecillis	Paper Pondshell		X	X	X
Quadrula pustulosa	Pimpleback		X	X	X
Potamilus alatus	Pink Heelsplitter		X	X	
Potamilus ohiensis	Pink Papershell		X	X	X
Tritogonia verrucosa	Pistolgrip		X	X	X
Lampsilis cardium	Plain Pocketbook		X	X	X
Uniomerus tetralasmus	Pondhorn	OT	X	X	
Cyclonaias tuberculata	Purple Wartyback	OSI	X	X	X
Quadrula cylindrica	Rabbitsfoot	OE	X	X	X
Villosa iris	Rainbow		X	X	X
Villosa fabalis	Rayed Bean	OE	X	X	X
Obovaria subrotunda	Round Hickorynut		X	X	X
Pleurobema sintoxia	Round Pigtoe		X	X	X
Simpsonaias ambigua	Salamander Mussel	OSI	X	X	
Alasmidonta viridis	Slippershell		X	X	X
Epioblasma triquetra	Snuffbox	OT	X	X	X
Elliptio dilatatus	Spike		X	X	X
Strophitus undulatus	Squawfoot		X	X	X
Amblema plicata	Threeridge		X	X	X
Fusconaia flava	Wabash Pigtoe		X	X	X
Megalonaias nervosa	Washboard	OE	X	X	
Lampsilis fasciola	Wavy-rayed Lampmussel		X	X	X
Lasmigona complanata	White Heelsplitter		X	X	X
		Total	**38**	**35**	**35**

Status codes: FE - Federally endangered; OE - Ohio endangered; OT - Ohio threatened; OSI - Ohio special interest

In all, Little Darby Creek appears to be in better condition than Big Darby Creek. Beginning at Chuckery, a high diversity is maintained to West Jefferson, with few interruptions (Figure 3). The Federal endangered Clubshell and Ohio endangered Rabbitsfoot were found living and reproducing in this area at several sites, but nowhere else in the system. Areas of unusually low diversity included West Jefferson. At the site immediately above the town, 124 living or freshly dead individuals of 12 species were found. At the first site below the town, no living or freshly dead mussels were encountered, despite apparently good habitat.

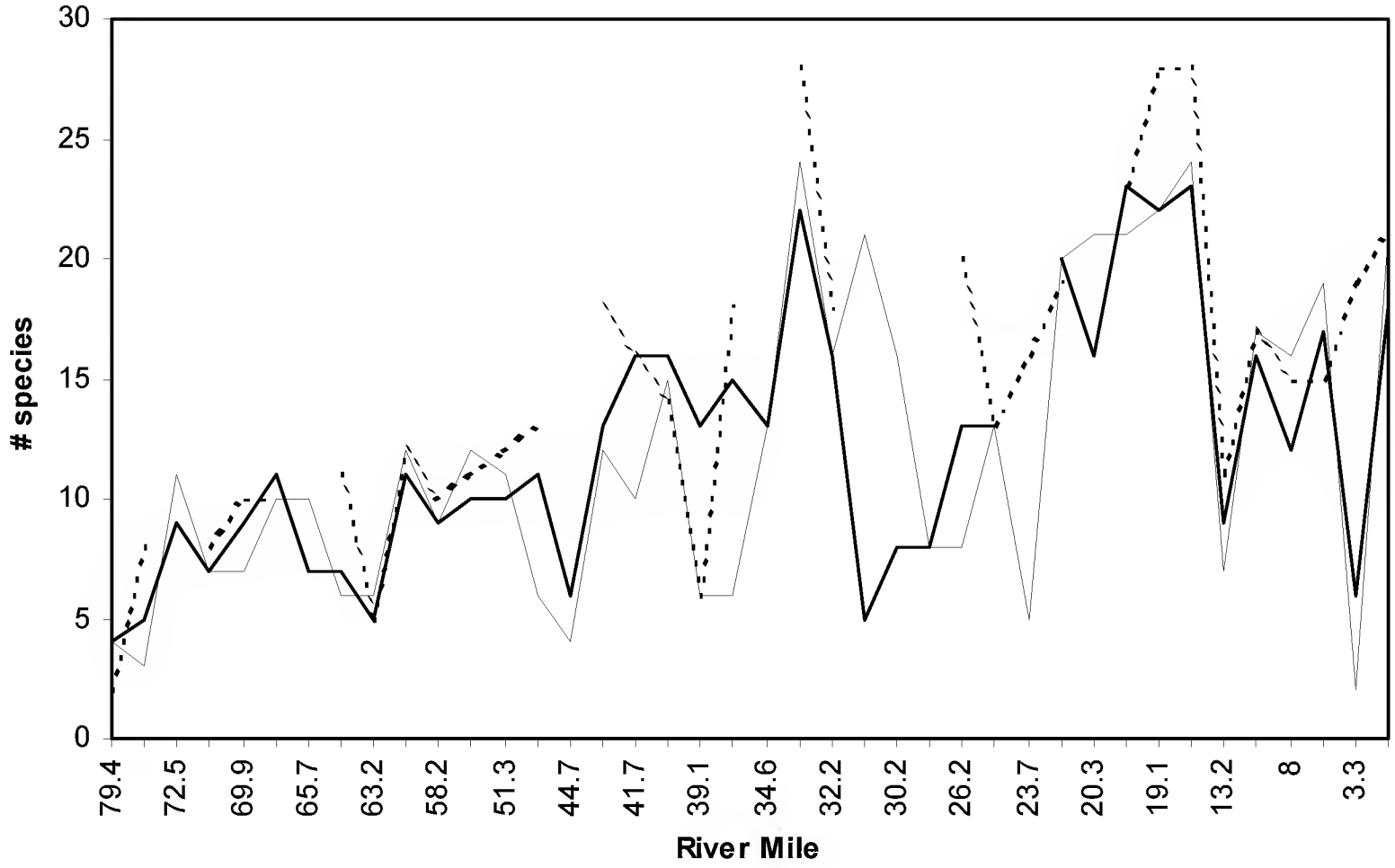

Figure 2. Big Darby Creek - number of species by river mile. Heavy line - 1996. Light line - 1990. Dashed line - 1986.

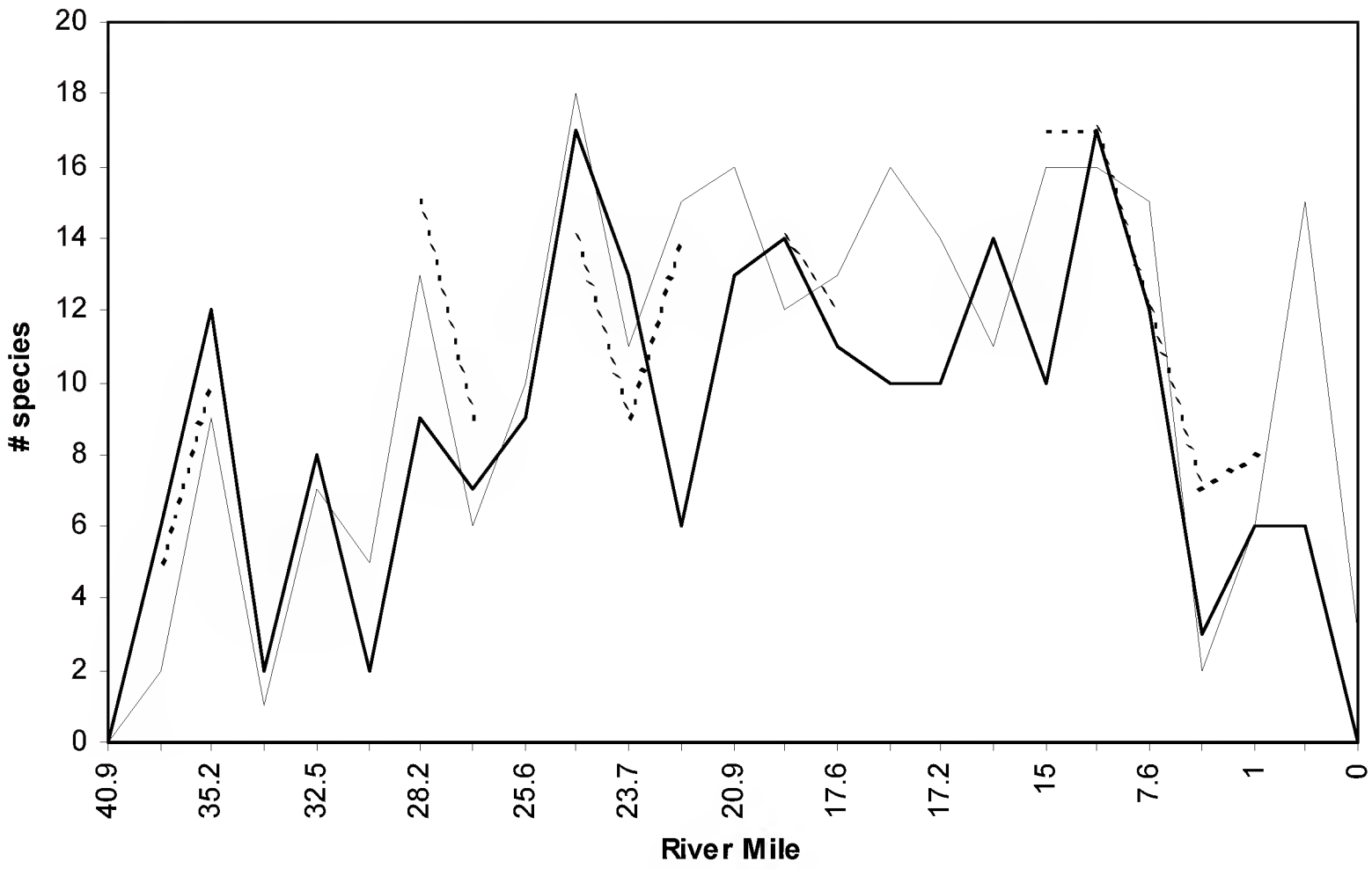

Figure 3. Little Darby Creek - number of species by river mile. Heavy line - 1996. Light line - 1990. Dashed line - 1986

Several tributaries no longer support any mussels at their downstream sites. Buck Run historically has had problems with livestock-induced runoff and pollution. Hellbranch Run lacks any evidence that mussels ever existed in its lowest stretch, where portions of the creek were buried under more than a foot of wastewater treatment effluent. The rare Pondhorn Mussel, known in the system only from this tributary, apparently has been extirpated.

No evidence of zebra mussels was found in the system. Zebra mussels have been recorded from the Scioto River and neighboring Hargus Lake. As a tributary of the Scioto River, the Darby Creek system is thus exposed to potential infestation. It is not clear whether zebra mussels can successfully colonize a free-flowing creek such as Big Darby. Certainly the construction of an impoundment on or adjacent to the Darby system would greatly increase the chances of zebra mussel invasion.

Big Darby Creek is internationally known as a high-quality freshwater ecosystem. Single sites in the draianage have more species than all of Europe. Conservation efforts from wildlife agencies, conservation groups, and private citizens have frequently collided with the plans of developers, industry, and urbanization that encroach on the Darby system. As with most fragile habitats, it is not a single problem that destroys it, but the cumulative effect of numerous insults and injuries. Already these effects are visible, such as in the declining numbers and diversity of the Darby organisms.

Listed Species Accounts

Black Sandshell, *Ligumia recta*, an Ohio threatened species, was found living in the 1988 survey, but not in 1990 or 1996. It has never been common in the system, although its proposed hosts, various sunfish and bass, are present (Steg and Neves, 1997).

Clubshell, *Pleurobema clava*, a Federal and Ohio endangered species, was encountered as weathered shells at all but the extreme headwater sites. It was found living or freshly dead in the middle reach of Little Darby Creek, where it is not uncommon. Several size classes were encountered. Hosts include the common Striped Shiner and Blackside Darter (Watters and O'Dee, 1997).

Deertoe, *Truncilla truncata*, an Ohio special interest species, was rare in 1988 and was not found in subsequent surveys. It is a large river species. Hosts include Sauger and Drum (Wilson, 1916), which may have introduced this mussel from the Scioto River.

Elephant ear, *Elliptio crassidens*, another large river species, is endangered in Ohio. A single weathered shell was found in 1990. Hosts include Skipjack Herring (Howard, 1914). The Elephant Ear probably was never a common, reproducing resident of the Darby system.

Fawnsfoot, *Truncilla donaciformis*, an Ohio threatened species, is very rare in Big Darby Creek. A single weathered shell was found in 1996. Sauger and Drum are hosts (Surber, 1913). As with the Deertoe, it probably was introduced from the Scioto River.

Northern riffleshell, *Epioblasma torulosa rangiana*, a Federal and Ohio endangered species, was historically common in Big Darby Creek mainstem. Although not encountered in 1996, it was found subsequently in the Battelle-Darby Metro Park region. Its numbers have steadily declined. Hosts include several darters and Mottled Sculpin (Watters, 1996b).

Snuffbox, *Epioblasma triquetra*, an Ohio endangered species, was once common in the lower mainstem of Big Darby Creek. It has become rare as its numbers dramatically decline. Logperch is a reported host (Hill, 1986).

Washboard, *Megalonaias nervosa*, an Ohio endangered species, occasionally is encountered in Big Darby Creek. These are all old, single individuals and probably represent stray occurances. Many fishes are known as hosts.

Pondhorn, *Uniomerus tetralasmus*, is threatened in Ohio, and known from only a few locales in the state. It historically lived in Hellbranch Run, but, curiously, nowhere else in Big Darby. It has been extirpated from the system. Golden Shiner is the only host reported (Stern and Felder, 1978).

Purple Wartyback, *Cyclonaias tuberculata*, an Ohio special interest species, was uncommon as living and freshly dead specimens in the middle mainstem. It does not appear to be reproducing. Known hosts are catfishes.

Rabbitsfoot, *Quadrula cylindrica cylindrica*, an Ohio endangered species, was found living or freshly dead at three Little Darby Creek sites. It has been extirpated from Big Darby Creek proper. This species appears to be reproducing, based on the several size classes and juveniles found in this survey. Hosts are probably species of shiners and chubs (Yeager and Neves, 1986).

Rayed bean, *Villosa fabalis*, an Ohio endangered species, and former Federal Category 2 species, was found as weathered shells in much of the Big Darby mainstem. It has been extirpated from most of its range in North America. The Tippecanoe Darter is believed to be a potential host.

Salamander mussel, *Simpsonaias ambigua*, an Ohio special interest species, and former Federal Category 2 species, was found as a freshly dead shell at a single site (T17). Its only known host, the Mudpuppy (Howard, 1915), was not encountered in 1996.

Museum records exist for two species not found in any of the three surveys discussed here. The Mucket, *Actinonaias ligamentina*, is common in many parts of Ohio, but peculiarly absent from Big Darby Creek. The Ridged Pocketbook, *Lampsilis ovata*, an Ohio endangered species, is known only from subfossil specimens and is presumed to be extirpated from the system.

Acknowledgments

All surveys were funded by the Ohio Chapter of The Nature Conservancy (TNC). Their support is greatly appreciated. Dr. Steve Sutherland (TNC) and Howard Albin (Columbus and Franklin County Metropolitan Park District) are acknowledged for the time and interest they gave to these studies.

Literature Cited

Hill, Donley M. 1986. Cumberlandian Mollusks Conservation Program, activity 3: Identification of fish hosts. Office of Natural Resources and Economic Development. Tennessee Valley Authority. Knoxville, Tennessee. 57 p.

Howard, Arthur D. 1914. Experiments in propagation of fresh-water mussels of the *Quadrula* group. Report of the U.S. Commissioner of Fisheries for 1913, Appendix 4:1-52 + 6 plates [Issued separately as U.S. Bureau of Fisheries Document 801].

Howard, Arthur D. 1915. Some exceptional cases of breeding among the Unionidae. Nautilus 29: 4-11.

Steg, Michelle B. and Richard J. Neves. 1997. Fish host identification for Virginia listed unionids in the upper Tennessee River drainage. Triannual Unionid Report 13: 34.

Stern, Edward M. and Darryl L. Felder. 1978. Identification of host fishes for four species of freshwater mussels (Bivalvia: Unionidae). American Midland Naturalist 100: 233-236.

Surber, Thaddeus. 1913. Notes on the natural hosts of fresh-water mussels. Bulletin of the Bureau of Fisheries 32: 103-116 + 3 plates [Issued separately as U.S. Bureau of Fisheries Document 778].

Watters, G. Thomas. 1986. A survey of the unionid molluscs of the Big Darby Creek system in Ohio. Final Report to the Ohio Chapter of The Nature Conservancy. 149 p.

Watters, G. Thomas. 1990. 1990 Survey of the unionids of the Big Darby Creek system. Final Report to the Ohio Chapter of The Nature Conservancy. Columbus, Ohio. 118 p.

Watters, G. Thomas. 1994. Unionidae of the Big Darby Creek system in central Ohio, USA. Malacological Review 27: 99-107.

Watters, G. Thomas. 1996a. 1996 Freshwater mussel survey of Big Darby Creek. Final Report to the Ohio Chapter of The Nature Conservancy. Columbus, Ohio. 4 p. + 2 appendices.

Watters, G. Thomas. 1996b. Hosts for the Northern Riffle Shell (*Epioblasma torulosa rangiana*). Triannual Unionid Report 10: 14.

Watters, G. Thomas and Scott H. O'Dee. 1997. Identification of potential hosts. Triannual Unionid Report 13: 38-39.

Wilson, Charles B. 1916. Copepod parasites of fresh-water fishes and their economic relations to mussel glochidia. Bulletin of the Bureau of Fisheries 34: 333-374 + 15 plates [Issued separately as U.S. Bureau of Fisheries Document 824].

Yeager, Bruce L. and Richard J. Neves. 1986. Reproductive cycle and fish hosts of the Rabbit's Foot Mussel, *Quadrula cylindrica strigillata* (Mollusca: Unionidae) in the Upper Tennessee River drainage. American Midland Naturalist 116: 329-340.

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Freshwater Mussel Surveys of the Fish Creek System in Ohio and Indiana

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Introduction

Fish Creek in Ohio and Indiana is one of the most diverse and biologically important mussel streams in North America. In all, thirty species have been recorded from the Fish Creek drainage, including three Federal endangered species, six Ohio endangered species, and five Indiana endangered species (Watters, 1988; 1996). The Federal endangered White Catspaw (*Epioblasma obliquata perobliqua*) may occur nowhere else.

Fish Creek was last surveyed, system-wide, in 1988. Since that time, the watershed has changed in several ways. Tree plantings and other bank-stabilization activities have reduced runoff potential to the stream. Changes in land usage, both improvements and detriments, are continually occurring. Finally, the lowest, most diverse reach of the stream was the site of a diesel fuel spill. The status of the mussel fauna of Fish Creek was unknown following these changes. It was not known if the overall health of the mussel populations had become better or worse since 1988.

Methods

Mussels were collected by hand picking during low-water conditions in 1996. All 30 sites studied in the 1988 survey in the Fish Creek system were resurveyed (Figure 1). All specimens were counted and identified. No live individuals were collected, but shells were vouchered at The Ohio State University Museum of Biological Diversity as allowed by permit.

Results and Discussion

Twenty-five species were found in this survey, slightly fewer than the 28 species found in 1988 (Table 1). Five listed species were encountered.

Salamander Mussel, *Simpsonaias ambigua*, an Indiana special concern and Ohio special interest species, and former Federal Category 2 species, was found as a freshly dead shell at a single site (79). This species has been found in most Fish Creek surveys, but never is common. Its only known host, the Mudpuppy, was not encountered in 1996.

Rayed Bean, *Villosa fabalis*, an Ohio endangered species, and former Federal Category 2 species, was found as freshly dead shells at four sites on the Ohio side. It has been extirpated from most of its range nationwide. Its hosts are unknown.

Rabbitsfoot, *Quadrula cylindrica cylindrica*, an Indiana and Ohio endangered species, was found living or freshly dead at five Ohio sites. This species appears to be reproducing, based on the several size classes and juveniles found in this survey. Hosts are probably species of shiners and chubs based on studies of the subspecies *Quadrula cylindrica strigillata* (Yeager and Neves, 1986).

Purple Wartyback, *Cyclonaias tuberculata*, an Ohio special interest species, was common as living and freshly dead specimens throughout the lower quarter of the system. It appears to be reproducing. Known hosts are catfishes (Hove *et al.*, 1997).

Clubshell, *Pleurobema clava*, a Federal, Ohio, and Indiana endangered species, was encountered as weathered shells at all but the extreme headwater sites. It was found living or freshly dead at nine sites, most within Ohio. It may be reproducing, as several size classes were encountered. Hosts are the Striped Shiner and Blackside Darter (Watters and O'Dee, 1997).

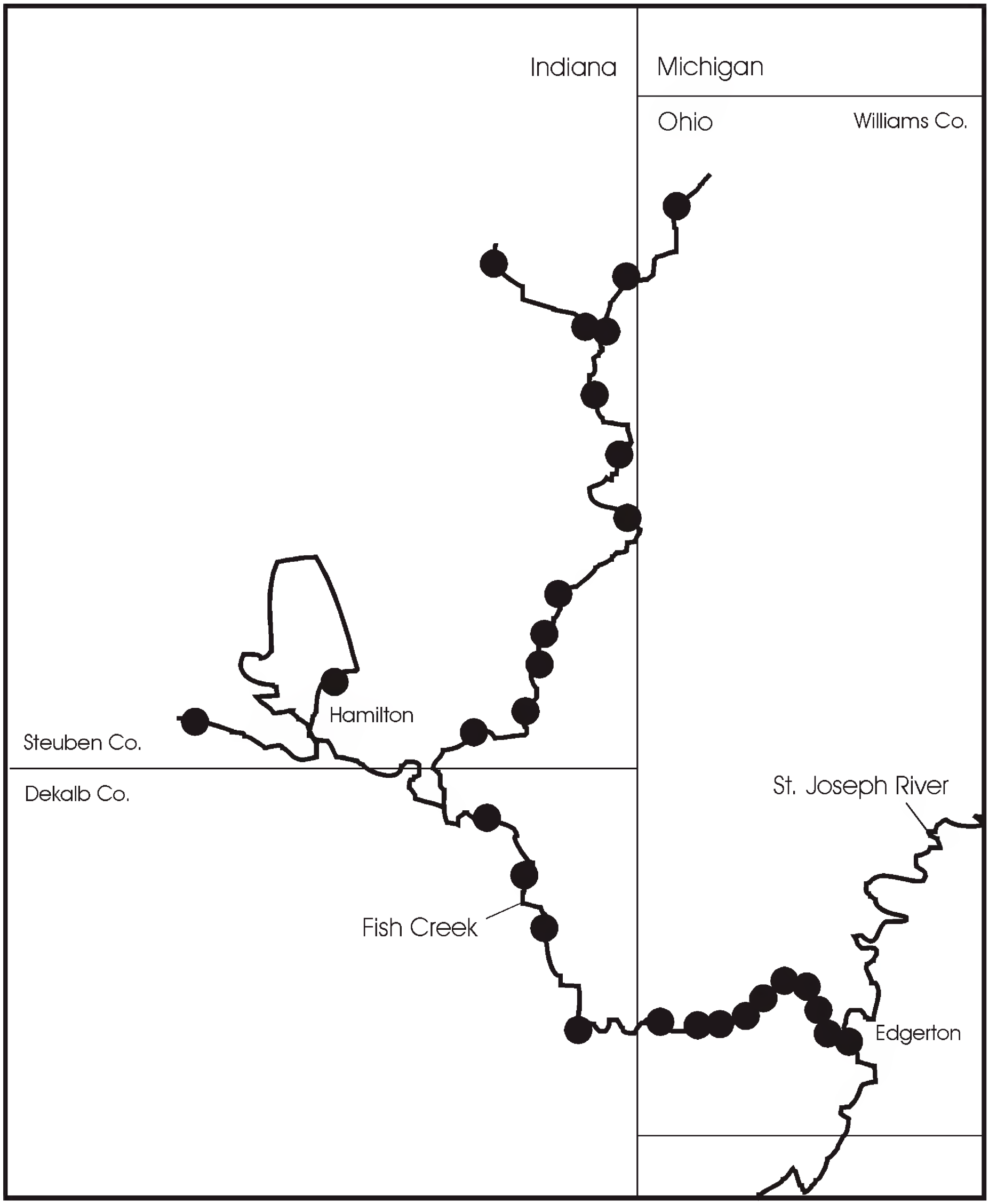

Figure 1. Map of collection locations on Fish Creek.

Table 1. Comparison of 1988 and 1996 surveys.

Taxon	Common Name	Status	1988	1996
Actinonaias ligamentina	Mucket		X	X
Alasmidonta marginata	Elktoe		X	X
Alasmidonta viridis	Slippershell		X	X
Amblema plicata	Threeridge		X	X
Anodontoides ferussacianus	Cylindrical Papershell		X	X
Cyclonaias tuberculata	Purple Wartyback	OSI	X	X
Elliptio dilatatus	Spike		X	X
Epioblasma o. perobliqua	White Catspaw	FE, OE, IE	X	
Epioblasma rangiana	Northern Riffleshell	FE, OE, IE	X	
Fusconaia flava	Wabash Pigtoe		X	X
Lampsilis cardium	Plain Pocketbook		X	X
Lampsilis fasciola	Wavy-rayed Lampmussel		X	X
Lampsilis radiata luteola	Fat Mucket		X	X
Lasmigona complanata	White Heelsplitter		X	X
Lasmigona compressa	Creek Heelsplitter		X	X
Lasmigona costata	Fluted-shell		X	X
Ligumia recta	Black Sandshell	OT	X	
Obovaria subrotunda	Round Hickorynut		X	X
Pleurobema clava	Clubshell	FE, OE, IE	X	X
Pleurobema sintoxia	Round Pigtoe		X	X
Ptychobranchus fasciolaris	Kidneyshell		X	X
Pyganodon grandis	Giant Floater		X	X
Quadrula cylindrica	Rabbitsfoot	OE, IE	X	X
Simpsonaias ambigua	Salamander Mussel	OSI, ISC	X	X
Strophitus undulatus	Squawfoot		X	X
Utterbackia imbecillis	Paper Pondshell		X	X
Villosa fabalis	Rayed Bean	OE	X	X
Villosa iris	Rainbow		X	X
		Total	**28**	**25**

Status codes: FE - Federally endangered; OE - Ohio endangered; IE - Indiana endangered; OT - Ohio threatened; OSI - Ohio special interest; ISC - Indiana special concern

The White Catspaw, *Epioblasma obliquata perobliqua*, a Federal, Ohio, and Indiana endangered species is now believed to occur only in Fish Creek. Only two living specimens have been found in the past eight years. No specimens, in any condition, were encountered in this survey. It may still exist in Fish Creek, but its numbers may have fallen below the level of detection.

The Northern Riffleshell, *Epioblasma torulosa rangiana*, another Federal, Ohio, and Indiana endangered species, was historically rare in Fish Creek. No evidence was found in this survey that it still occurs in the drainage. Like the White Catspaw, it may still live in Fish Creek, but it is very rare.

Figure 2 depicts the species diversity from mouth to headwaters for both surveys. Twenty-three of the 30 sites have fewer species in 1996 than in 1988. I believe this is due, at least in part, to the exceptional survey conditions in 1988. A severe drought in 1988 resulted in the stranding of numerous mussels, rendering collection extremely easy. By contrast, 1996 had above-normal precipitation. Although survey work was conducted to maximize the likelihood of encountering as many species as possible, few mussels were stranded or otherwise unburied. This alone probably accounts for most of the departure in terms of diversity of 1996 from 1988. The 1988 drought continued for several years and undoubtedly resulted in the death of a significant portion of the mussel fauna.

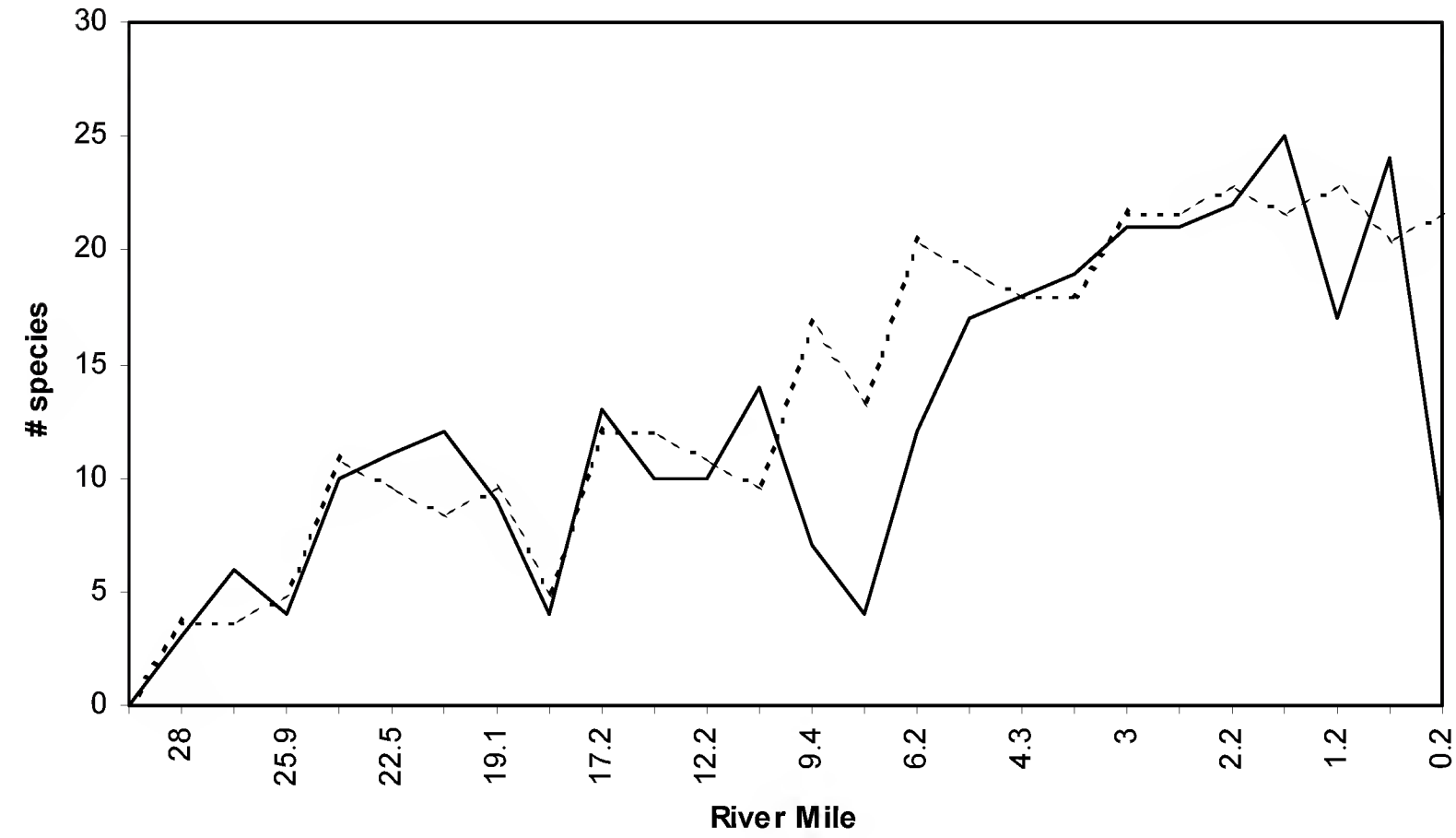

Figure 2. Number of species by river mile. Solid line - 1988. Dashed line - 1996.

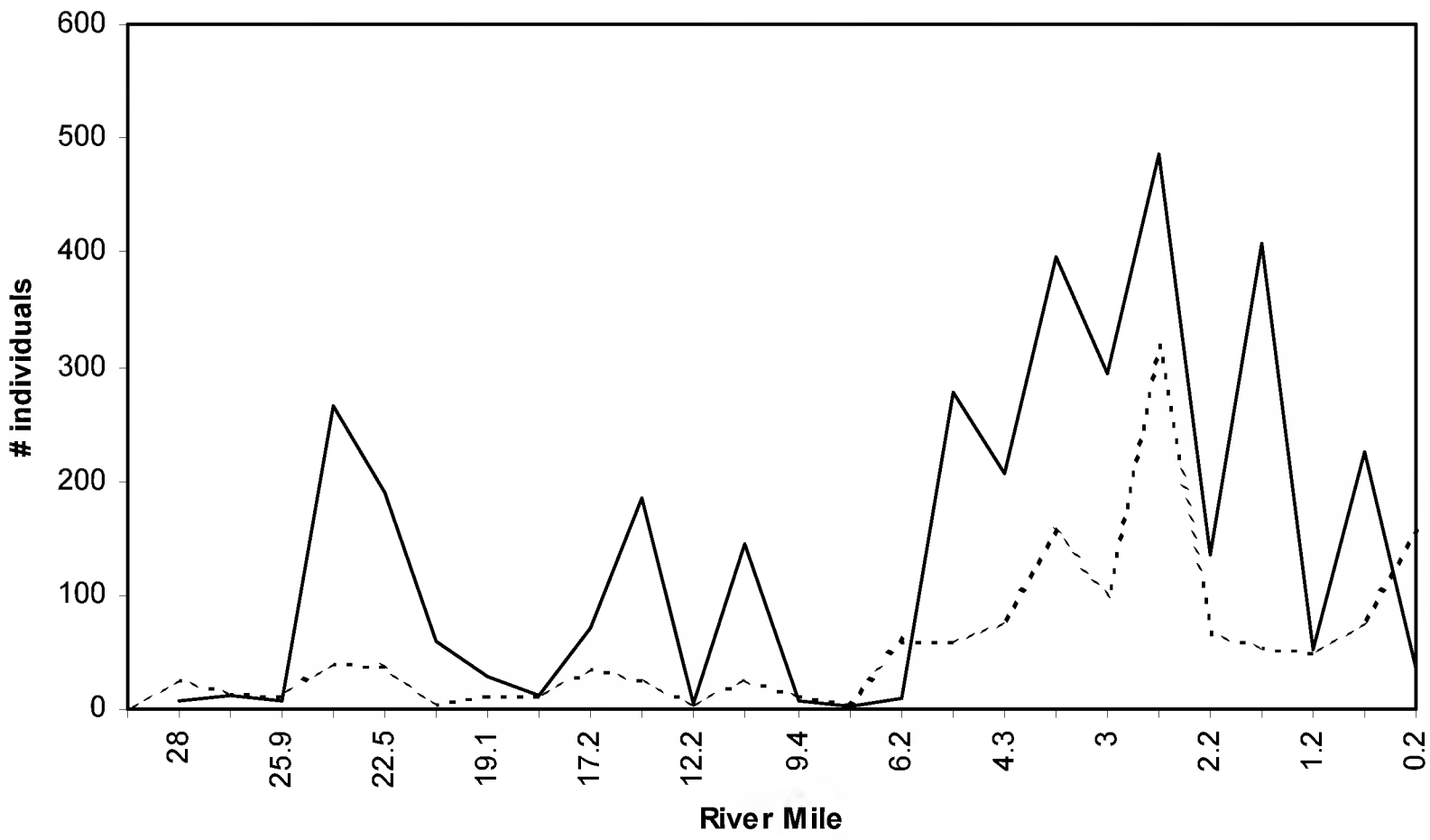

Figure 3. Number of living and freshly dead individuals of all species by river mile. Solid line - 1988. Dashed line - 1996.

Figure 3 depicts the numbers of living or freshly dead individuals encountered in 1996 and 1988. There is a significant difference between the two surveys that cannot be explained solely as the result of drought conditions in 1988. In 1988, 3520 individuals were encountered; in 1996, only 1189. The four most abundant species in Fish Creek were Threeridge, Kidneyshell, Fat Mucket, and Spike, although these species occupy different habitats within the system. All four were encountered less frequently in 1996. However, as fewer total individuals were encountered in the 1996 surveys as a whole, this result was not unexpected. But differences between each of these four species expressed as the percentage of the total individuals found of all species at a site, indicate that all four species have declined in relative abundance, particularly the Threeridge. This species was dramatically less common at several sites, notably Site 25, where 101 living individuals were found in 1988, but only one in 1996. This result is mirrored in other midwestern systems. These data indicate that certain species may be declining for unknown reasons.

Fish Creek remains among the most important sources of mussel diversity in North America. This survey suggests that declines in mussel populations found throughout the Midwest are evident in Fish Creek as well. Although overall diversity has not dramatically deteriorated, there is a suggestion that overall abundance of individuals, particularly of some once common species, has declined. The reasons for this are not clear, and certainly are not due to any one cause.

Acknowledgments

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Literature Cited

Hove, Mark C., Robin A. Engelking, Margaret E. Peteler, Eric M. Peterson, Anne R. Kapuscinski, Laurie A. Sovell, and Elaine R. Evers. 1997. Suitable fish hosts for glochidia of four freshwater mussels. Pages 21-25 *in* Conservation and Management of Freshwater Mussels II. Proceedings of a UMRCC Symposium, 16-18 October 1995, St. Louis, Missouri. Kevin S. Cummings, Allan C. Buchanan, Christine A. Mayer, and Teresa J. Naimo, editors. Upper Mississippi River Conservation Committee. Rock Island, Illinois. 293 p.

Watters, G. Thomas. 1988. A survey of the freshwater mussels of the St. Joseph River system, with emphasis on the federally endangered White Cat's Paw Pearly Mussel. Final Report to the Indiana Department of Natural Resources and US Fish & Wildlife Service. 127 p.

Watters, G. Thomas. 1996. 1996 survey of the freshwater mussels of the Fish Creek drainage. Final Report to the Indiana Chapter of The Nature Conservancy. Indianapolis, Indiana. 4 p., appendices.

Watters, G.Thomas and Scott H. O'Dee. 1997. Identification of potential hosts. Triannual Unionid Report 13: 38-39.

Yeager, Bruce L. and Richard J. Neves. 1986. Reproductive cycle and fish hosts of the Rabbit's Foot Mussel, *Quadrula cylindrica strigillata* (Mollusca: Unionidae) in the Upper Tennessee River drainage. American Midland Naturalist 116: 329-340.

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A Survey of Amphibian Species Richness and Breeding Habitats at the Denison University Biological Reserve (Licking County, Ohio)

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Abstract. Inventories of salamanders and frogs were conducted at the Denison University Biological Reserve from April 1996 through October 1998 in order to establish baseline data for habitat assessment, to initiate long-term monitoring of the Reserve, and to inform management policy. Amphibians were surveyed in forest, lotic, and lentic habitats by visual searches of cover, taped aural censuses, aquatic netting, seining, and use of drift fences and pitfall traps. Breeding populations of nine Caudata and eight Anura species were found during the two year survey including *Ambystoma maculatum*, *Ambystoma texanum*, *Plethodon glutinosus*, *Eurycea bislineata, Rana palustris,* and *Rana sylvatica*; all species that had not been collected previously at the Reserve. However, numbers of *Eurycea longicauda* and *Pseudotriton ruber* have apparently declined in three spring-fed brooks in the Alrutz Section of the Reserve since an earlier study in 1966.

Introduction

The Denison University Biological Reserve was established in 1966 as an outdoor laboratory for biology and environmental education. Since then, the Reserve has been managed to provide the greatest possible diversity in habitats, ecotones, flora, and fauna. Collections of various floral and faunal specimens have been made during undergraduate courses, but no comprehensive or systematic inventories of the flora or fauna of the Reserve were made prior to 1996. The Reserve was recently extended to 350 acres with the addition of the Taylor-Ochs Section, and a series of faunal and floral surveys were initiated with the goals of establishing complete inventories of representative taxa, assessing the quality of diverse habitats, and obtaining baseline data for long-term monitoring of specific indicator taxa against a background of urban development in Granville Township.

Amphibians were selected as one of several indicator taxa for the assessment of aquatic habitats within the Reserve. A brief survey of the salamanders within the original 100 acre (approx. 42 ha) parcel (Alrutz Section) of the Reserve was conducted in 1966 as a student research project (Stewart, 1966), whereas other amphibians have been collected intermittently during herpetology courses. However, no previous inventory of the Anura has been conducted. Here we report the first comprehensive assessment of amphibian species richness and breeding sites at the Denison University Biological Reserve.

Materials and Methods

Study Site

The Denison University Biological Reserve is located in Granville Township within Licking County, Ohio (40°5' N, 82°31' W). Approximately 70% is wooded with a mosaic of beech-maple forest, deciduous floodplain forest, and coniferous plantations (Figure 1). The remaining 30% consists of former agricultural fields maintained in early and late successional stages by a mowing regime. The Reserve is bisected and drained by Clay Run which originates north of the Taylor-Ochs Section and joins Clear Run at the Reserve's southeastern boundary. Both streams are perennial, but the upper three tributaries of Clay Run in the Taylor-Ochs Section are seasonal, often drying up by August. Throughout the year, Clay Run is fed by seven springs and three brooks. Within the Alrutz Section, the flow of Clay Run is permanent but regulated by the outflow of a reservoir on private property to the north. Searches for plethodontid salamanders focused on these lotic habitats and the adjacent woodlands.

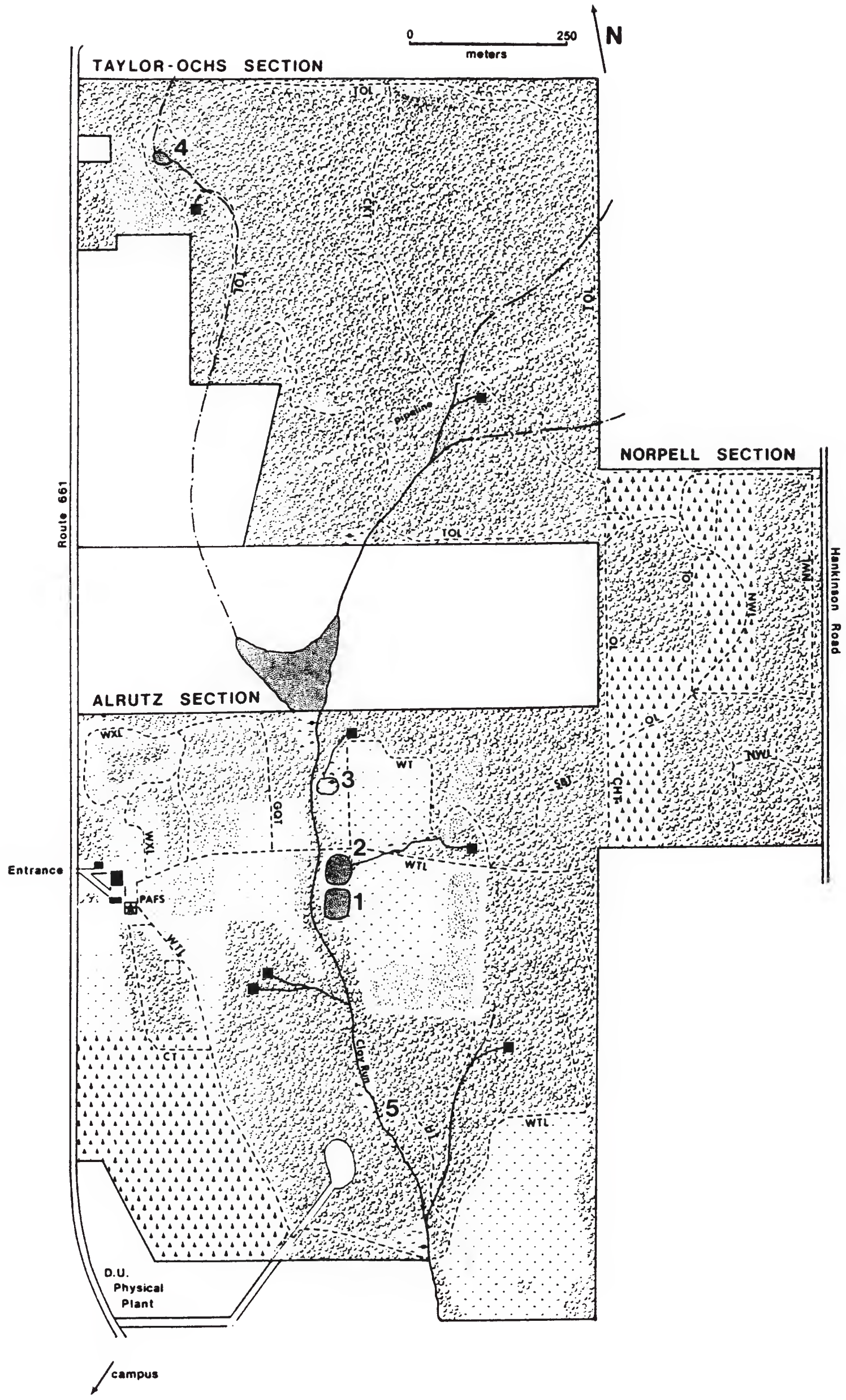

Figure 1. Map of the Denison University Biological Reserve. Amphibian survey sites include: 1) Wood Duck Pond, 2) Spring Peeper Pond, 3) Old Minnow Pond, 4) Taylor-Ochs Pond, 5) Clay Run. Springs are indicated by solid squares. Upper case letters are trail name abbreviations.

The Reserve includes four artificial ponds (Figure 1), each with different physical characteristics, which were the sites for surveys of breeding frogs and salamanders. Spring Peeper Pond, located in the Alrutz Section, is spring-fed but shallow, and occasionally dries up during summer droughts. It drains into the deeper and permanent Wood Duck Pond, which in turn drains into Clay Run. Old Minnow Pond, also in the Alrutz Section, is spring-fed but silted-in, and overgrown with cattails (*Typha latifolia*). The pond drains into Clay Run via a breech in the dam and constitutes a marsh with flowing water. The Taylor-Ochs Pond is a temporary pond that receives flow from a farm pond to the north of the Reserve and drains into the northwestern reaches of Clay Run. It regularly dries up by August, but may refill temporarily with late summer and autumn rains.

Survey Methods

An initial list of potential species to be found at the Reserve was created by consulting records for Licking County and central Ohio in Walker (1946) and Pfingsten and Downs (1989). Based on their habitat preferences and breeding season, searches of the Reserve were conducted in the appropriate season and habitat for all the potential species on the list. Larvae and aquatic adults were surveyed by kick-seining and turning over rocks in spring brooks and Clay Run, and by aquatic netting and seining in the four ponds from April through August. To detect breeding activities of ambystomatid salamanders, visual searches of ponds and vernal pools for egg masses were conducted from February through March in 1996 and 1997 and drift fencing (50 meters long) was placed around Spring Peeper Pond in March 1997. Upland habitats were surveyed for adult plethodontid salamanders by turning over rocks, logs, and other cover along 100 meter transects parallel to Clay Run, and along steep talus slopes. To determine the vegetation associated with salamander habitats, the tree species compositions along these transects were determined using a standard transect/circular plot method. Within each circular plot (10 meters in radius), tree species with stems greater than one meter tall and 2.5 centimeters in diameter at 1.5 meters from the ground were identified and counted.

Censuses for breeding frogs and toads were conducted from March 1996 through May 1998 around the four ponds and along Clay Run using a combination of aural census and visual searches with an aquatic net to confirm species identity. Anuran breeding calls were recorded with a parabolic microphone and compared to a tape of *The Frogs and Toads of Ohio* available from the Ohio Biological Survey and the Borror Acoustic Laboratory, Museum of Biological Diversity, The Ohio State University. We attempted to locate and count as many calling males as possible, but estimated the size of each chorus to the nearest five individuals at each site.

Habitat Assessment

Several abiotic and biotic conditions of each pond site within the Reserve were measured in conjunction with the amphibian surveys. Biotic conditions included percentage and composition of pond edge and submerged vegetation, and the presence of fish. Abiotic factors included pond size, permanence, depth, pH, dissolved oxygen, phosphates, free CO_2, nitrates, silica, and hardness. The latter chemical characteristics were measured with a LaMotte® limnology kit.

Results

Species Richness

A total of 18 amphibian species, nine salamanders and nine anurans, were recorded at the Biological Reserve between April 1996 and July 1998. Breeding sites were confirmed by the location of eggs, larvae, or chorusing males. Each species is listed below with a brief description of habitat and abundance. Nomenclature follows the *Standard Common and Current Scientific Names for North American Amphibians and Reptiles* (Collins, 1997). Voucher specimens were deposited in the Denison University vertebrate collection.

Caudata—Although Pfingsten and Downs (1989) reported 15 species for Licking County, none of their records included Granville Township. Nine of the 15 species they listed were found at the Biological Reserve. Our survey revealed five species not previously observed or collected at the Reserve including two species of *Ambystoma*.

Ambystoma maculatum (Shaw) - Spotted Salamander: Rare, found only at one pond. Egg masses were discovered at the Taylor-Ochs Pond in March 1997 and 1998. Several larvae were collected from the pond with aquatic nets in June 1997. New record for the Reserve.

Ambystoma texanum (Mathes) - Small-mouthed Salamander: Rare. Two adults were caught in a drift fence pitfall trap at the Spring Peeper Pond in early March 1997. New record for the Reserve. This species was found crossing the Newark-Johnstown bike path in Granville two miles southwest of the Reserve during rainy nights in March 1996-1998.

Desmognathus fuscus (Rafinesque) - Northern Dusky Salamander: Common. Consistently found under flat pieces of sandstone at three woodland springs in the Alrutz Section and two within Taylor-Ochs Section.

Eurycea bislineata (Green) - Northern Two-lined Salamander: Uncommon. Adults and larvae were found in Old Minnow Pond and at one spring in the Alrutz Section. Larvae were collected by kick-seining in Clay Run and Clear Run at the extreme south end of the Reserve. New record for the Reserve.

The taxonomic status of *E. bislineata* in Ohio is unresolved (Guttman in Pfingsten and Downs, 1989). Two cryptic species were distinguished electrophoretically by Guttman and Karlan (1986), and Jacobs (1987) subsequently grouped the southern Ohio populations (*E.* n. sp. in Guttman and Karlan, 1986) with *E. cerrigera*, the southern two-lined salamander. Because morphological characters distinguishing the two species are lacking, and populations in Licking County were identified as *E. b. bislineata* in the study by Guttman and Karlin, we have conservatively listed the two-lined salamanders of the Reserve as *E. bislineata*. However, it should be noted that the Reserve lies near to the narrow hybrid zone identified by Guttman and Karlin.

Eurycea longicauda (Green) - Longtail Salamander: Uncommon. Adults and larvae were consistently observed at springs in the Alrutz Section. Adults were found occasionally under logs in the adjacent beech-maple woods.

Plethodon cinereus (Green) - Northern Redback Salamander: Common. Adults of the red-backed phase were found only in old secondary forest dominated by beech-maple-oak, and were especially common in the drier woods of the eastern Alrutz and Taylor-Ochs Sections.

Plethodon glutinosus (Green) - Northern Slimy Salamander: Rare. Two individuals of the Slimy Salamander were found in April 1998 on steep slopes in beech-maple woods of the Alrutz Section where slabs of Byers sandstone were exposed. New record for the Reserve.

Plethodon richmondi Netting and Mittleman - Ravine Salamander: Uncommon. Mature adults and young of *P. richmondi* were found sporadically in the secondary woodland growth of all three sections of the Reserve. New record for the Reserve.

Pseudotriton ruber (Latreille) - Red Salamander: Common. Adults and larvae were found regularly in spring-fed brooks in the Alrutz Section and where flows entered and left Old Minnow Pond and Spring Peeper Pond.

Anura—Nine of the 12 potential frog and toad species listed for Licking County (Walker, 1946) were found at the Reserve. Chorusing males were observed and heard at every pond, but each pond differed in the anuran assemblage it supported (Table 1). Both Spring Peeper Pond and Wood Duck Pond, separated by less than 10 meters, were breeding sites for six species, but with slight differences. Spring Peeper Pond supported far more hylids and toads than Wood Duck Pond and lacked leopard frogs (*Rana pipiens*). Old Minnow Pond was visited only by spring peepers (*Pseudacris crucifer*) and American toads (*Bufo americanus*) and low numbers of each. The temporary pond in Taylor-Ochs supported large populations of early season breeders and common gray treefrogs (*Hyla versicolor*), and was the sole known breeding site of wood frogs (*Rana sylvatica*) in the Reserve.

Bufo americanus Holbrook - American Toad: Common**.** This toad formed breeding choruses at all four ponds during early May. Calling males were most abundant (10-15 males/pond/night) at Spring Peeper Pond and at the Taylor-Ochs Pond. Adult and juvenile toads were encountered occasionally on woodland trails in all three Sections of the Reserve.

Pseudacris crucifer (Wied-Neuweid) - Spring Peeper: Abundant. Breeding males (20-30 males/pond/night) at Spring Peeper Pond and Taylor-Ochs Pond during April and early May. Numbers were lower at Wood Duck Pond (< 10 males/pond/night) and Old Minnow Pond (< 5 males/pond/night).

Pseudacris triseriata (Wied-Neuweid) - Western Chorus Frog: Occasional. Fewer than five calling males heard each April at Spring Peeper Pond and Taylor-Ochs Pond.

Table 1. Occurrence of amphibians found during visual and aural surveys of the four ponds and woodland habitat of the Denison University Biological Reserve, 1996-98. Anuran numbers are estimated number of calling males.

Species	Spring Peeper	Wood Duck	Old Minnow	Taylor-Ochs	Other
Ambystoma maculatum				eggs/larvae	
Ambystoma texanum	adults				
Desmognathus fuscus					springs
Eurycea bislineata	larvae		larvae		springs
Eurycea longicauda	larvae		larvae		springs
Plethodon cinereus					woods
Plethodon richmondi					woods
Plethodon glutinosus					woods
Pseudotriton ruber	larvae		larvae		brooks
Bufo americanus	> 10		< 5	> 10	woods
Pseudacris crucifer	> 20	> 10	> 5	> 20	
Hyla versicolor	> 10	> 5		> 20	woods
Pseudacris triseriata	< 5	< 5		< 10	
Rana catesbiana	> 10	> 5			
Rana clamitans	> 10	> 5		< 5	Clay Run
Rana pipiens		< 5			
Rana palustris					brook
Rana sylvatica				> 5	

Hyla versicolor LeConte - Common Gray Treefrog: Common. Large choruses (20-30 males/pond/night) at Taylor-Ochs Pond in late May to mid-June. Smaller numbers (5-10 males/pond/night) at Spring Peeper Pond and Wood Duck Pond. Individuals heard occasionally in the woods of Taylor-Ochs Section. This species was identified by comparing calls of males recorded in the field on warm nights with those of *H. versicolor* and *H. chrysoscelis* recorded on *The Frogs and Toads of Ohio*, an audio tape produced by the Borror Acoustic Laboratory.

Rana catesbeiana Shaw - Bullfrog: Common. Year-round resident of ponds. Choruses of 5-10 males/pond/night in June at Spring Peeper and Wood Duck Ponds.

Rana clamitans Latreille - Green Frog: Abundant. Year-round resident of ponds and stretches of Clay Run. Choruses of 10-15 males/pond/night in June at Spring Peeper and Wood Duck Ponds. Occasional individuals in Taylor-Ochs Pond.

Rana pipiens Schreber - Northern Leopard Frog: Occasional. Fewer than 5 males heard each April-May in Wood Duck Pond only.

Rana palustris LeConte - Pickerel Frog: Rare. Three adult frogs, ranging in size from 40 to 60 mm in length were found in September 1998 along the spring-fed brook flowing into Old Minnow Pond. New record for the Reserve.

Rana sylvatica LeConte - Wood Frog: Uncommon. Breeding choruses were recorded in mid- to late February in 1997 and 1998 at the Taylor-Ochs Pond where egg masses were subsequently found during March. Occasional males were heard at Spring Peeper Pond. New record for the Reserve.

Amphibian Habitats

Although *Desmognathus fuscus* and *Pseudotriton ruber* were found in several springs and brooks within the Reserve, they were absent from two spring-fed brooks in the Alrutz Section where they had been previously reported as abundant by Stewart (1966). Compared to sites where the salamanders were found in 1996-98, the two historic sites were densely overgrown with honeysuckle (*Lonicera* sp.), blackberry (*Rubus* sp.), and rose (*Rosa* sp.). In addition, a rusting silo had fallen into one of the brooks.

Plethodontid salamanders were found under logs in the eastern portions of both the Alrutz and Taylor-Ochs Sections that have been wooded for over 70 years. These sections had more large treefalls and cover than younger woodlots on the western side of both sections. Transects where salamanders were found were in stands of mature sugar maple (*Acer saccharum*) along with other late successional species such as beech (*Fagus grandifolia*), red oak (*Quercus borealis*), and shagbark hickory (*Carya ovata*). Salamander species were largely absent from transects in floodplain woods characterized by sycamores (*Platanus occidentalis*), slippery elm (*Ulmus rubra*), ironwood (*Carpinus caroliniana*), and yellow poplar (*Lirodendron tulipifera*). They were also absent from upland sections of the Reserve that had been heavily grazed 50 years ago and are now dominated by honeysuckle, fire cherry (*Prunus pennsylvanica*), and osage orange (*Maclura pomifera*).

During this study the four ponds at the Reserve each exhibited a different set of abiotic and biotic characteristics related to different depths and permanence of standing water (Table 2). Wood Duck Pond was the largest, deepest, and most permanent of the lentic habitats, and contained the largest population of predatory fish, such as bluegills and sunfish (*Lepomis* sp.). Spring Peeper Pond was shallower, supported more cattails (*Typha latifolia*) and rush (*Juncus* sp.), and was frequently covered with duckweed (*Lemna* sp.) and watermeal (*Wolfia* sp.) as the water level dropped through the summer. Annual declines in water level and winter freezing were probably responsible for the absence of predatory fish in Spring Peeper Pond. Old Minnow Pond retained flowing water all summer, but had the shortest water column and a meter of soft sediment. With the dam breached, the pond had become a sediment trap with a continuous surface current flowing through marsh-like conditions; the surface is completely covered by cattails and rush. The Taylor-Ochs Pond is equal in size to Spring Peeper Pond but shallower and dries up every summer, preventing the establishment of fish and emergent vegetation. In several respects, the Taylor-Ochs Pond is similar to a vernal pond.

Table 2. Biotic and abiotic characteristics of the four ponds at the Denison University Biological Reserve measured in July 1996.

	Spring Peeper	**Wood Duck**	**Old Minnow**	**Taylor-Ochs**
Approximate area (ha)	0.60-0.40	0.86	0.60	0.50-0.00
Approximate depth (m)	0.7 -0.5	0.95	0.05	0.6-0
Emergent vegetation	80%	40%	95%	0%
Shoreline vegetation	90%	100%	75%	90%
Algal coverage	100%	80%	0%	0%
Presence of fish	no	yes	yes	no
pH	8	7.5	8	7.2
Carbon dioxide (ppm)	0	3	0	14
Calcium hardness (ppm)	72	56	112	84
Magnesium hardness (ppm)	44	28	102	68
Silica (ppm)	5-6	4-5	10	4
Nitrate (ppm)	0.2	0.2	0.5	0.2
Orthophosphate	0.2	0.5	0.2	na

The chemical characteristics of each pond were only measured during mid-summer and found to be well within the tolerances of most amphibians (Freda, 1986). The pH values were neutral or slightly alkaline for the four ponds. The ponds did differ in degree of hardness, but the source of these minerals was unknown. At the time of first measurement, the three Alrutz Section ponds were found to be low in carbon dioxide, nitrates, and phosphorus levels. However, all three increased toward the end of the summer of 1996, and high levels of nitrates and phosphorus were measured for Spring Peeper and Wood Duck Ponds during the fall of 1996. These increases were attributed not only to eutrophication, but an influx of fecal matter produced by Canada Geese feeding in the vicinity of the ponds.

Discussion

This faunal survey revealed species assemblages of amphibians at the Biological Reserve that are typical and representative of central Ohio. However, due to a high degree of habitat heterogeneity, the Reserve supports a high species richness within a small area. Patterns of species abundance in specific habitats indicate specific ecological conditions involving both abiotic and biotic factors. Longitudinal comparisons with the study in 1966 and previous collections indicate changes in some of those factors.

The salamander assemblage depends upon both terrestrial and aquatic habitats that continue to undergo succession because the land was in cultivation, tree (primarily conifer) plantation, or in pasture prior to 1965. The oldest woods in the Reserve are approximately 70-80 years old and located in the southeastern corner of both the Alrutz and Taylor-Ochs Sections. Aerial photographs from 1951 show closed canopies of mature trees in these areas. These are also the areas that support modest populations of *P. cinereus*, *P. richmondi*, *P. glutinosus*, and *E. longicauda*; four species indicative of rich soils and old growth woods (Pough *et al.*, 1987). However, censuses in early October 1997 showed that *P. cinereus* was 4.5 times more common along transects in similar habitat at Black Hand Gorge Nature Preserve (Licking County). The fact that forest habitats in the Reserve prior to 1965 were confined to only a few dry hilltops may explain the low densities of these woodland salamanders. Plethodontid salamanders have yet to colonize these areas that are now under succession to mixed mesophytic forest. A policy established in 1990 to leave tree falls to decompose has increased cover and microhabitats for these woodland species.

The springs and streams of the Reserve provide habitat and breeding sites for several salamanders, and warrant further and more detailed investigation. The seven springs in both the Alrutz and Taylor-Ochs Sections support a large population of *D. fuscus* and supply brooks that support *P. ruber*. Where these brooks join Clay Run, however, these salamanders are excluded by siltation and fish predation. The absence of salamanders from two spring-fed brooks where they were common in 1967 is of concern. This decline is correlated with the growth of thorny shrubs that have shaded over the brooks, blocking sunlight to aquatic plants and reducing throughfall of organic material (J. Fauth, personal communication). These invasive plants, as well as the rusting silo, were removed during the summer of 1998 to restore the spring and brook.

Six additional species of salamanders, reported by Pfingsten and Downs (1989) for Licking County (but not Granville Township), were not found at the Reserve. Three of these species occupy habitats not found at the Reserve. The spring salamander, *Gyrinophilus porphyriticus* (Green), is strongly associated with the unglaciated portion of Ohio. *Hemidactylium scutatum* (Schlegel), the four-toed salamander, requires sphagnum bogs in mature forest. The marbled salamander, *Ambystoma opacum* (Gravenhorst), prefers temporary ponds in low swamp forest (Pfingsten and Downs, 1989). Like *A. maculatum*, Jefferson salamanders, *Ambystoma jeffersonianum* (Green), prefer temporary pools in well-drained, upland woodlots and are potential residents near the temporary woodland pond of the Taylor-Ochs Section. However, this pond is probably unsuitable for tiger salamanders, *Ambystoma tigrinum* (Green), because it dries up in August before larvae can finish development (Pfingsten and Downs, 1989). No tiger salamanders have been recorded from the Reserve farm ponds. Likewise, no specimens of the eastern newt, *Notophthalmus viridescens* (Rafinesque) have been found in the Reserve despite frequent sampling of aquatic habitats. The Reserve ponds may be unsuitable for newts because each is influenced significantly by a stream or spring (Gates and Thompson, 1982).

Of the frogs and toads, nine of the 12 potential species were found, with *P. crucifer* and *B. americanus* being most numerous and chorusing at every pond in the Reserve (Table 1). Other hylids included small numbers of *P. triseriata* at the Spring Peeper Pond and large numbers of *H. versicolor* chorusing in June at both the Spring Peeper and Taylor-Ochs Ponds. *Rana clamitans* and *R. catesbeiana* were the most common ranids. Only a few *R. pipiens* were heard chorusing each April at Wood Duck Pond and specimens of *R. palustris* were discovered only after the initial survey. Numerous chorusing males of both species were heard along nearby Raccoon Creek in Granville. No specimens or calls of cricket frogs (*Acris crepitans*) or Fowler's toads (*Bufo woodhousii fowleri*) have been recorded for the Reserve and it was determined (S. Moody, personal communication) that the Reserve lacks suitable habitat for eastern spadefoot toads (*Scaphiopus holbrookii*).

The four ponds at the Reserve differed in the anuran assemblage each supported (Table 1). Spring Peeper and Wood Duck Ponds, separated by less than 10 meters, both supported breeding populations of six species, but with slight differences. Spring Peeper Pond supported far more hylids and bufonids than Wood Duck Pond and lacked *Rana pipiens*. Old Minnow Pond supported only *P. crucifer* and *B. americanus* and low numbers of each. The temporary pond in Taylor-Ochs supported large populations of early season breeders and *H. versicolor*, and was the sole known breeding site of *R. sylvatica* in the Reserve.

The four ponds of the Reserve are all artificial, but constitute an array of lentic habitats that support different and diverse amphibians depending on the permanence of water and presence of fish. For example, *A. maculatum* and *R. sylvatica*, two early spring breeders whose larvae are intolerant of fish (Pfingsten and Downs, 1989) breed in the Taylor-Ochs Pond which regularly dries up by August, thereby excluding large predatory fish populations. Spring Peeper Pond also lacks fish and supports the greatest numbers of breeding hylid frogs. This pond also has an abundance of emergent vegetation for calling hylid frogs. Wood Duck Pond provides the greatest area and vegetative structure, and is the one truly permanent pond at the Reserve. Consequently it supports the largest number of ranid frogs and sunfish. Bullfrogs and bluegills are known to feed on tadpoles of other, smaller frog species (Bruggers, 1973; Hayes and Jennings, 1984) which may explain the lower numbers of hylid frogs at this pond.

Because this study provides initial baseline information for future longitudinal studies, it is difficult to speculate on the reasons why some species of amphibians that are common in central Ohio were not found in this survey. However, some hypotheses may be advanced which can be subsequently tested. With regard to the aforementioned salamander species, there may have been inadequate time for re-colonization of this former farmland, or distances between suitable habitats are too great for re-colonization. With respect to frogs, the one species that seems unusually rare at the Reserve is the western chorus frog, *Pseudacris triseriata*. During this study, large choruses of this species were heard in shallow, grassy ponds in nearby Granville. Perhaps unknown habitat requirements are lacking, or populations are depressed by the large populations of odonates (Schultz, in preparation) as demonstrated in experimental ponds by Van Buskirk (1988). Alternatively, former populations of this species may have been extirpated by farming in the past.

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Literature Cited

Bruggers, Richard L. 1973. Food habits of bullfrogs in northwest Ohio. The Ohio Journal of Science 73(3): 185.

Collins, Joseph T. 1997. Standard Common and Current Scientific Names for North American Amphibians and Reptiles . Society for the Study of Amphibians and Reptiles Herpetological Circular 25: 1-40.

Freda, Joseph. 1986. The influence of acid pond water on amphibians: A review. Water, Air and Soil Pollution 30: 439-450.

Gates, J. Edward and Edward L. Thompson. 1982. Small pool habitat selection by red-spotted newts in western Maryland, USA. Journal of Herpetology 16(1): 7-15.

Guttman, Sheldon I. and Alvin A. Karlin. 1986. Hybridization of cryptic species of two-lined salamanders (*Eurycea bislineata* complex). Copeia 1986(1): 96-108.

Hayes, Marc P. and Mark R. Jennings. 1986. Decline of ranid frog species in western North America: Are bullfrogs (*Rana catesbeiana*) responsible? Journal of Herpetology 20: 490-509.

Jacobs, Jeremy F. 1987. A preliminary investigation of geographic genetic variation and systematics of the two-lined salamander, *Eurycea bislineata* (Green). Herpetologica 43(4): 423-446.

Pfingsten, Ralph A. and Floyd L. Downs, eds. 1989. The Salamanders of Ohio. Ohio Biological Survey Bulletin New Series, Volume 7, Number 2. Columbus, Ohio. xx + 315 p.+ 29 pls.

Pough, F. Harvey, Ellen M. Smith, Donald H. Rhodes, and Andres Collazo. 1987. The abundance of salamanders in forest stands with different histories of disturbance. Forest and Ecology Management 20: 1-9.

Stewart, James R. 1966. Salamanders of the Denison University Biological Reserve. (Senior research thesis under supervision of Robert W. Alrutz). 23 p.

Van Buskirk, Josh. 1988. Interactive effects of dragonfly predation on experimental pond communities. Ecology 69: 857-67.

Walker, Charles F. 1946. The Amphibians of Ohio: Part 1, The Frogs and Toads. Ohio State Museum of Science Bulletin Volume 1, Number 3. The Ohio State Archaeological and Historical Society. Columbus, Ohio. 109 p.

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First Ohio Nesting Attempt of the Clay-colored Sparrow, *Spizella pallida* (Swainson)

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Introduction

The Clay-colored Sparrow's nesting range was described by Bent "as occurring mainly in the upper Plains and Canadian Prairie Provinces, east of the Rockies to northern Michigan and western Ontario" (Bent, 1968). This species expanded east into and became more numerous in Michigan during the early 1900s. Today its center of distribution in Michigan is in the western Upper Peninsula and north central Lower Peninsula, where it regularly associates with Kirtland's Warbler (*Dendroica kirtlandii*). Breeding pairs are found as far south as the "Thumb Region," of Sanilac, St. Clair, and Genesse counties south and east of Saginaw (McPeek, 1994).

On June 6, 1996, at approximately 7:30 A.M., while conducting a breeding bird survey in a large grassland area at Battelle-Darby Creek Metro Park (Pleasant Township, Franklin County, Ohio), the senior author identified the 3-4 note repetitive "buzzy" song of the Clay-colored Sparrow (*Spizella pallida*). The bird was found in a small American elm (*Ulmus americanus*) in an adjacent old field. It flew in a territory of approximately one-quarter acre (0.10 ha) singing from several perches. The bird was observed for about two hours by up to four observers, during which time it was also photographed.

On or about June 26, two separate reports of a second bird were made to Metro Parks. On July 1, park naturalist Mac Albin also felt confident that he had observed a second Clay-colored Sparrow in the territory. On July 2, the site was visited approximately 7:00 A.M. and observed from two vantage points. Once again, the male was singing in the American elm.

At 8:05 A.M., the second bird was located and observed carrying nesting material. The bird, which was presumed to be the female, flew into a multiflora rose, then appeared a few moments later where she was joined by the male and was observed mating in a dead shrub.

The pair was observed at some distance for approximately 35 minutes, and the female was photographed carrying nesting material. As she made several trips to the adjacent grass field to collect nesting material, she was always accompanied by the male, who made no effort to collect any nesting material. As the female returned to the nest site, the male perched in a nearby tree and resumed singing. This "male guarding" habit was consistent during the entire time of observation, and the male accompanied her on every trip in several directions. This behavior was also recorded in Michigan by Walkinshaw (1944) in the 1940s.

Clay-colored Sparrow nest with eggs. Photograph by Lawrence Igl, U.S. Geological Survey.

After these observations, the nest was located and appeared to be nearly complete. The nest was composed of grass with a lining of finer grassy material. The nest was woven into the center of the multiflora rose and supported by the larger stems.

The habitat was an old field with scattered small green ash (*Fraxinus pennsylvanica*), honey locust (*Gleditsia triacanthos*), hawthorns (*Craetagus* sp.), and American elms. Herbaceous species consisted of cool season grasses, black-eyed susans (*Rudbeckia hirta*), and prairie coneflower (*Ratibida pinnata*). The territory was estimated to be approximately one-quarter acre (0.10 ha) in a field of about 5 acres (2.0 ha). An adjacent 20-acres (8.0 ha) of grassland/old field were also used for the collection of nest material.

On July 10, the area was rechecked. No eggs were found in the nest and the female could not be located. The male however, was still present on the territory and singing. On July 24, the area was searched thoroughly in hopes of locating the female or a second nest. Neither the male nor female was present and the original nest was in the same condition. The following measurements of the nest were recorded: Outside diameter 2.875 inches (7.1875 cm), inside diameter 1.75 inches (4.375 cm), depth 1.75 inches (4.375 cm). The shrub chosen for the nest site was 44 inches (1.12 m) tall and the nest was placed 7.5 inches (18.75 cm) above the ground.

This is the first known nesting attempt of the Clay-colored Sparrow in Ohio. The details of this record were first published in *The Ohio Cardinal* (Watts and Albin, 1996), along with a photograph, thus documenting Ohio's first nesting attempt. The first Ohio specimen was collected by Charles F. Walker on South Bass Island on May 12, 1940 (Peterjohn, 1989). Peterjohn (1989) describes the Clay-colored Sparrow as a casual but fairly regular spring migrant along Lake Erie, mostly from Ottawa and Lucas counties and near Cleveland. Accidental records also exist for Franklin and Butler counties. Most Ohio records occur between April 25 and May 22. They have been recorded two of every three years since 1976.

Literature Cited

McPeek, Gail A., editor. 1994. Birds of Michigan. Indiana University Press. Bloomington and Indianapolis, Indiana. xv + 358 p.

Peterjohn, Bruce G. 1989. Birds of Ohio. Indiana University Press. Bloomington and Indianapolis, Indiana. xiii + 237 p.

Root, Oscar M., contributor. 1968. *Spizella pallida* (Swainson) Clay-colored Sparrow. Pages 1186-1208 *in* Life Histories of the North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows and Allies Part II by Arthur Cleveland Bent and collaborators. Smithsonian Institution Press. Washington, D.C. v-xi + 603-1248 p. + Plates 33-67.

Walkinshaw, Lawrence Harvey. 1944. Clay-colored Sparrow Notes. Jack-Pine Warbler 22: 119-131.

Watts, John and Mac Albin. 1996. First documented Ohio nesting attempt of the Clay-colored Sparrow. The Ohio Cardinal 19(4): 104-105.